GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. _____

Project No. E-26-625 * DATE 3/24/82

Project Director: Dr. Bernd Kahn School/Lab NE

Sponsor: U. S. Dept. of Interior; Office of Water Research and Technology; Washington, D.C.

Type Agreement: Annual Cooperative Program Grant #14-34-0001-2111

Award Period: From 10/1/81 To ~~9/30/82~~ ~~9/30/83~~ 9/30/83 (Performance) 11/30/82 (Reports)

Sponsor Amount: $26,460* (includes $1,400 to Dr. North at U.G.) Contracted through: ~~GTRI~~/GIT

Cost Sharing: $14,583 (E-26-326)

Title: FY'82 Institute Director's Office

ADMINISTRATIVE DATA

OCA Contact Leamon R. Scott

1) Sponsor Technical Contact:

U. S. Dept. of Interior
Office of Water Research & Technology
Assistant Director - Research
Washington, D.C. 20240
202-343-5345

2) Sponsor Admin/Contractual Matters:

U. S. Dept. of Interior
Office of Water Research & Technology
Chief, Contracts & Grants Center
Washington, D. C. 20240
Admn. Mgr. 202-343-4607

Defense Priority Rating: N/A

Security Classification: N/A

RESTRICTIONS

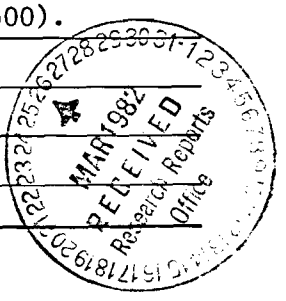
See Attached N/A Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel to be in accordance with OWRT Policy/Procedures Memorandum 78-1, "OWRT Policy/Procedure regarding use of OWRT contract/grant funds to support travel-related costs of non-federal persons."

Equipment: Title vests with GIT

COMMENTS:

* FY 1982 Grant includes, in addition to E-26-625, the following projects:
E-20-E01/Aral ($5,873); E-20-E02/Cross ($9,000); E-20-E03/Saunders ($9,500).



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Computer Input
Project File
Other _____

FORM OCA 4:781

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

N. 4 SR 1/8

Date 11/8/85

Project No. E-26-625 School NE

Includes Subproject No.(s) (T) E-20-E01; (T) E-20-E02; (T) #-20-E03; (T) B-10-685; (T) G-35-637

Project Director(s) Dr. Bernd Kahn / GIT

Sponsor U. S. Dept. of Interior; Office of Water Policy

Title FY '82 Institute Director's Office

Effective Completion Date: 9/30/83 (Performance) (Reports)

Grant/Contract Closeout Actions Remaining:

[X] None

[ ] Final Invoice or Final Fiscal Report

[ ] Closing Documents

[ ] Final Report of Inventions

[ ] Govt. Property Inventory & Related Certificate

[ ] Classified Material Certificate

[ ] Other

NOTE: Project File was to have terminated when all projects under the Annual Cooperative Program (BOA #73) were Completed. A review of OCA Files indicates that all Sponsor Reporting Requirements were met and than this project should be terminated.

Continues Project No. E-26-667 Continued by Project No.

COPIES TO:

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Project File
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FORM OCA 69.285

ERC 12-82 December 1982

ANNUAL REPORT

WATER RESOURCES RESEARCH ACTIVITIES IN GEORGIA

UNDER PUBLIC LAW 95-467

FISCAL YEAR 1982

Environmental Resources Center
Georgia Institute of Technology
Atlanta, Georgia 30332

ABSTRACT

The annual report of the Environmental Resources Center in administering the Water Research and Development Act in Georgia during Fiscal Year 1982 is presented. The Center is in the Office of Interdisciplinary Programs at the Georgia Institute of Technology. One of its main activities is managing the Annual Cooperative Program and Matching Grant projects in the Georgia Water Resources Research Program, for which Federal funds are provided by the U.S. Department of the Interior.

The four parts of the annual report present summaries of (1) Center research management and information dissemination activities, (2) Annual Cooperative Program projects, (3) Matching Grant projects and (4) Focused Research projects during FY 1982. Five Annual Cooperative Program projects were begun during the year, seven projects begun in the previous year were being completed and technical completion reports for several earlier projects were prepared. Ten reports of completed work were published.

PART I

SUMMARY OF ENVIRONMENTAL RESOURCES CENTER ACTIVITIES

A. Director's Statement

B. Program Operation

C. Information Dissemination

A. DIRECTOR'S STATEMENT

The Environmental Resources Center at the Georgia Institute of Technology manages the cooperative Federal-state water resources research program in Georgia according to the Water Research and Development Act of 1978 (PL 95-467). It is one of 54 water resources research institutes located in each state and in several other political divisions. Federal and matching State funds enable the institutes to maintain a systematic program of university research for supporting water resources management in the state and region. The U.S. Department of the Interior provides Federal funding and program guidance. State support in Georgia is by the University System at the institution where the research is performed. The research program is developed in close coordination with the state water resources management agency, the Environmental Protection Division of the Georgia Department of Natural Resources.

The research priorities of the Environmental Resources Center are recommended by the Georgia Water Resources Research Program Development Committee (see enclosed Table for membership). The current priorities address the topics identified in a 5-year plan developed in 1980 in accord with Federal law and USDI regulations. The following guidelines were prepared on the basis of this plan:

1) A comprehensive water use plan for the state and its subdivisions should be developed to permit most effective use of water resources.

2) The components of the water cycle must be better quantified for river basins and ground water aquifers to provide the basis for water use plans.

3) Conflicting demands for water resources must be resolved where the supply is limited.

4) Many municipal and industrial treatment facilities require expanded capacity and improved management for better downstream surface water quality.

5) The groundwater resource in central and south Georgia must be quantified to determine if or when steps must be taken to prevent depletion due to the rapid expansion of intensive agricultural application.

6) Withdrawal of groundwater in coastal Georgia must be controlled to reduce saltwater intrusion due to aquifer depletion by industrial water users.

7) Existing and potential problems due to erosion and sedimention, flood or drought, and hazardous wastes in water need to be addressed.

The projects active in FY 1982 reflect these priorities where opportunities for research exist, within the limits of available funding and in-state research capability and interest. Studies were begun to obtain

information concerning the water cycle by examining causes of regional droughts (A-097-GA) and determining basin-scale evapotranspiration values (A-103-GA). A project to develop an integrated state water budget process (A-104-GA) was selected but has been deferred until the principal investigator completes an earlier project. Studies related to the prudent and effective use of ground water include an improved mathematical approach to aquifer parameter predictions (A-091-GA), inferring potential well capacity from observed topographical characteristics (A-086-GA), and examining agricultural irrigation efficiency (A-102-GA). Means of controlling water pollution by ozonation (A-095-GA) and sludge digestion (A-092) were tested. In addition, the public is being assisted in understanding and participating in water resources management by means of a film on Georgia water resources (A-100-GA) and a survey of Georgia law on water resources and wetlands (A-101-GA).

One effective project that has just been completed is an Irrigation System Efficiency Survey for Georgia (A-102-GA), the initial portion of an extensive program of performance testing selected pumping plants and associated irrigation systems. This was performed at 15 farms in east central and southwest Georgia; the program is now being continued by another sponsor. The pumping plants, tested according to performance standards developed by the University of Nebraska, showed efficiencies relative to rated values between 44 and 122 percent, with an average of 83 percent. Coefficients of water application uniformity ranged from 71 to 88 percent. Water application was in close agreement with the amounts expected by the farmers. The results were encouraging with regard to the general quality of performance; where performance was substandard, guidance was provided for increased performance. The project yielded improved techniques for performing the full survey.

Another useful project concerned Least Cost Wastewater Management Alternatives for Discharges into Small Ungaged Streams (A-087-GA). This research provides guidance for correctly sizing wastewater treatment facility components and selecting an appropriate effluent release schedule to meet stream quality standards. A generalized facility simulation model and an optimization model are presented for use in designing wastewater treatment plants for small communities. A "hydrograph-controlled" release permit is suggested to permit optimum plant operation without exceeding acceptable stream pollution levels.

The Center continued its information and technology transfer activities through publishing and distributing its technical reports, making available reports from other water resources research institutes and from Federal agencies, and in responding to inquiries by professionals and the general public. The enclosed list of published reports indicates the range of problems addressed by USDI-sponsored projects. A major contribution toward providing state-of-the-art information and delineating current and future problems was the series of five South-Atlantic-Gulf regional conferences concerning (1) legal and administrative systems, (2) water conservation, (3) urban stormwater management, (4) groundwater management, and (5) toxic wastes control.

B. PROGRAM OPERATION

The Environmental Resources Center completed its eighteenth year of administering water resources research activities for Georgia with funds from the U.S. Department of the Interior, initially under the Federal Water Resources Research Act (P.L. 88-379) and currently under the Water Research and Development Act of 1978 (P.L. 95-467). In fiscal year 1982, 8 active Annual Cooperative Program projects, 4 Matching-Grant projects, and 2 National Focused Research Program projects were supported; in addition, several earlier projects were being completed. A total of $110,388 in federal funds was provided for the Annual Cooperative Program, $41,600 for Matching-Grant projects, and $145,500 for the Focused Research Program projects on water conservation. Implementation of the program for FY 1983 awaits a decision by the Federal government concerning continuation of water resources research support.

The ERC, located at the Georgia Institute of Technology, is operated as part of the Office of Interdisciplinary Programs under the guidance of the Georgia Water Resources Research Advisory Committee (see Table 1). The staff members listed in Table 2 carry out its program. The professional staff members hold appointments in academic departments, teach, and undertake research. Dr. Ronald North, Director of the Institute of Natural Resources at the University of Georgia, participates in ERC activities with specific regard to administering the water resources research at the University of Georgia.

The water resources research program is given direction by priority needs selected with the assistance of the Georgia Water Resources Research Program Development Committee listed in Table 3. These priority needs accompany invitations to submit brief proposals that are circulated to potential principal investigators at Georgia universities and colleges. Annual Cooperative Program and Matching-Grant projects are usually announced at the beginning of the calendar year for the next fiscal year, to begin October 1. Each submitted brief proposal is reviewed by three members of the Georgia Water Resources Research Technical Review Panel (see Table 4) competent in fields pertinent to the proposal. Proposals are rated on their technical merit and applicability to the research priorities. The comments and reviews are made available to the authors of the proposals and those given high rating are encouraged to prepare detailed research proposals.

The Georgia Water Resources Research Program Development Committee completed its ninth full cycle of recommending water resources research priorities to ERC in this year. Each year, the Committee meets to consider research responses to the priority needs of the past year and to reorder the priority list as appropriate. The resulting priority list, given in the preceding section, will be utilized by ERC to plan the research program for FY 1983.

The ERC works closely with the State water resources agency -- the Environmental Protection Division (EPD), Georgia Department of Natural Resources. The EPD staff prepares priority research outlines of its most pressing water resources problems. Each priority research item is assigned to an EPD project coordinator, who evaluates project proposals for appli-

cability to state needs and maintains communication with the principal investigators of the selected projects. This program keeps EPD abreast of research developments and provides information and assistance to the principal investigators.

The ERC participates in program planning with OWRT and with other states in the South-Atlantic-Gulf region. Cooperative efforts include exchanging information to select priority research problems and eliminate duplication, planning conferences and workshops, and developing regional research projects. A 4-year cycle of regional conferences has been completed. Summary reports have been published for all five conferences; proceedings have been published for four of them and the one for the fifth conference is being prepared. Programs of research and technology transfer are being undertaken on the basis of presentation at these conferences.

As part of its active information dissemination and technology transfer program, 10 reports of completed projects were published in the Environmental Resources Center series in FY 1982 (see Table 5). The Biennial Water Resources Research Conference for Georgia was held May 24 and 26, 1982.

The ERC professional staff also undertakes environmentally-related training and research activities sponsored by other agencies. Among the latter is the operation of the Environmental Radiation Laboratory, which is responsible for research to develop effective radiological monitoring in the environment and provides analytical radiometric capability for the state of Georgia. Project sponsors include the U.S. Nuclear Regulatory Commission and the Georgia Department of Natural Resources.

C. INFORMATION DISSEMINATION

The list of ERC publications given in Table 5 includes all completion reports, annual reports of the Center, and other water resources research reports considered to be of value and interest to the audience for these publications. The publications are distributed to the other water resources research institutes and centers, to USDI, and to the National Technical Information Service (NTIS). A limited number of complimentary copies are available for researchers who need these reports.

Reports listed in Table 5 with P.B. numbers may be purchased from the NTIS, U.S. Department of Commerce, Springfield, Virginia 22161, at the indicated price. Reproductions of these reports may also be purchased from the Georgia Tech Information Exchange Center at the Price Gilbert Library for 1) $0.20 per page plus a $3.00 handling charge for southeastern academic institutions or 2) $0.25 per page plus a $4.00 handling charge for academic institutions outside the southeast and all others. Those who want multiple copies of a report or who need a report after the Center's supply has been exhausted can be accomodated by one of these two methods.

The Environmental Resources Center maintains three mailing lists as part of its information dissemination program. The first is for those who request copies of all future ERC reports. The second is for those who wish to receive abstracts of all new ERC reports as they are published so that they can use the abstracts to request reports of particular interest. The third is for those individuals who wish to obtain a list of water resources research reports received by ERC from water resources research institutes in the other states and from non-USDI research groups. The reports are deposited every few months in the Georgia Tech Library, and deposited items are recorded. Recipients of this record can then borrow or purchase copies from the Information Exchange Center at the Library.

TABLE 1

GEORGIA WATER RESOURCES RESEARCH ADVISORY COMMITTEE

Advises the Director on Operating Policies and Procedures

Chairman: Bernd Kahn, Director, Environmental Resources Center

University of Georgia

R.C. Anderson, Vice President for Research

R. H. Brown, Head, Agricultural Engineering Department
College of Agriculture

R. M. North, Director, Institute of Natural Resources

Alternate

J. D. Hewlett, Professor, School of Forest Resources

Georgia Institute of Technology

T. E. Stelson, Vice President for Research

W. M. Sangster, Dean, College of Engineering

J. M. Spurlock, Director, Office of Interdisciplinary Programs

Alternate

J. W. Dees, Director, Office of Contract Administration

Regents, University System of Georgia (Observer)

H. R. Pounds, Vice Chancellor for Research and Planning

TABLE 2

ENVIRONMENTAL RESOURCES CENTER

Staff in FY 1982

Bernd Kahn, Professor and Director

Donald W. Kolberg, Senior Research Scientist and Associate Director

Celeste A. Cone, Senior Secretary

TABLE 3

GEORGIA WATER RESOURCES RESEARCH PROGRAM DEVELOPMENT COMMITTEE

Advises the Director on Water Resources Research Needs in Georgia

Member	Representative
DEPARTMENT OF NATURAL RESOURCES 1983	
Mr. Joe D. Tanner, Commissioner Department of Natural Resources Room 710, Trinity-Washington Building 270 Washington Street, SW Atlanta, Georgia 30334 (404) 656-3500	Mr. Gene Welsh, Chief Water Protection Branch Environmental Protection Division Department of Natural Resources Room 825, Trinity-Washington Building 270 Washington Street, SW Atlanta, Georgia 30334 (404) 656-6953 Mr. William H. McLemore, Chief Georgia Geologic Survey Department of Natural Resources Room 402, Agriculture Building 7 M.L. King, Jr. Drive, SW Atlanta, GA 30334 (404) 656-3214 Mr. Chris White, Chief Water Resources Management Branch Environmental Protection Branch Department of Natural Resources Room 825, Trinity-Washington Bldg. 270 Washington Street, SW Atlanta, GA 30334 (404) 656-3094
CORPS OF ENGINEERS, SOUTH ATLANTIC DIVISION 1984	
General Kenneth McIntyre, Div. Engr. South Atlantic Division Corps of Engineers 30 Pryor Street, SW Atlanta, Georgia 30303 (404) 526-6711	Mr. John Rushing, Chief Environmental Resources Branch S. Atlantic Division, Corps of Engrs. 510 Title Bldg., 30 Pryor Street Atlanta, Georgia 30303 (404) 526-4331
U.S. ENVIRONMENTAL PROTECTION AGENCY 1985	
Mr. Charles R. Jeter, Regional Admin. Environmental Protection Agency 345 Courtland Street, NE Atlanta, Georgia 30365 (404) 881-4727	Mr. John T. Marlar, Chief Water Quality Management Branch Environmental Protection Agency 345 Courtland Street, NE Atlanta, Georgia 30309 (404) 881-3012
GEORGIA CONSERVANCY, INC. 1984	
Mrs. Barbara Smith, Program Director Georgia Conservancy, Inc. 3110 Maple Drive, Suite 407 Atlanta, Georgia 30305 (404) 262-1967	Mrs. Pat Jeanson Georgia Conservancy, Inc. 3110 Maple Drive, Suite 407 Atlanta, Georgia 30305 (404) 262-1967

GEORGIA INSTITUTE OF TECHNOLOGY

Dr. Bernd Kahn, Director
Environmental Resources Center
Georgia Institute of Technology
Atlanta, Georgia 30332
(404) 894-2375

Dr. Donald W. Kolberg
Associate Director, ERC
Georgia Institute of Technology
Atlanta, Georgia 30332
(404) 894-2375

GEORGIA POWER COMPANY 1985

Mr. C.R. Thrasher
Manager of Engineering
Georgia Power Company
P.O. Box 4545 (404) 522-6060
Atlanta, Georgia Ext. 2372

Mr. M.H. Thompson, Jr.
Chief of Civil Engineering
Georgia Power Company
P.O. Box 4545 (404) 522-6060
Ext. 2524

GEORGIA AREA PLANNING AND DEVELOPMENT COMMISSIONS 1983

Mr. Ted Fortino, Executive Director
Altamaha Georgia Southern Area
Planning and Development Agency
P.O. Box 328
Baxley, Georgia 31513
(912) 367-3648

same

U.S. GEOLOGICAL SURVEY 1983

Mr. John R. George, Program Officer
S.E. Regional Office
U.S. Geological Survey
6481 Peachtree Industrial Blvd.
Suite B
Doraville, Georgia 30340
(404) 221-4858

same

UNIVERSITY OF GEORGIA

Dr. Ronald M. North, Director
Institute of Natural Resources
University of Georgia
Athens, Georgia 30602
(404) 542-1555

same

GEORGIA STATE SOIL AND WATER CONSERVATION COMMITTEE 1985

Mr. Gary L. Tyre
Executive Director
Georgia State Soil and Water
Conservation Committee
1867 West Broad Street
Athens, Georgia 30606
(404) 542-3065

Mr. Graham Liles
Georgia State Soil and Water
Conservation Committee
1867 West Broad Street
Athens, Georgia 30606
(404) 542-3065

TABLE 4

GEORGIA WATER RESOURCES RESEARCH

TECHNICAL REVIEW PANEL

Mr. Loris Asmussen
Program Director
Southeast Watershed Research Program
Coastal Plain Experiment Station
Tifton, Georgia 31794

Dr. Winfred M. Baldwin, Jr.
Associate Professor
Department of Chemistry
University of Georgia
Athens, Georgia 30602

D. E. H. Barman
Assistant Professor
Department of Biology
Georgia College
Milledgeville, Georgia 31601

Dr. Arthur C. Benke
Associate Professor
School of Biology
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Robert H. Brown
Professor and Head
Department of Agricultural Engineering
College of Agriculture
University of Georgia
Athens, Georgia 30602

Dr. Robert E. Carver
Associate Professor
Department of Geology
College of Arts and Sciences
University of Georgia
Athens, Georgia 30602

Dr. T. Lloyd Chesnut
Director
Office of Research Services
Georgia College
Milledgeville, Georgia 31601

Dr. James L. Cooley
Research Associate
Institute of Ecology
University of Georgia
Athens, Georgia 30602

Dr. Thomas F. Craft
Senior Research Scientist
School of Nuclear Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. John R. Crenshaw
Professor
School of Biology
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Charles D. Delorme
Professor, Economics Dept.
College of Bus. Administration
University of Georgia
Athens, Georgia 30602

Dr. Peter E. Dress
Associate Professor
School of Forest Resources
University of Georgia
Athens, Georgia 30602

Dr. Richard G. Dudley
Assistant Professor
School of Forest Resources
University of Georgia
Athens, Georgia 30602

Dr. David W. Duttweiler
Laboratory Director
Environmental Research Lab
Environmental Protection Agency
College Station Road
Athens, Georgia 30605

Dr. Geoffrey G. Eichholz
Regents' Professor
School of Nuclear Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. William R. Ernst
Assistant Professor
School of Chemical Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Austin O. Esogbue
Professor
Industrial and Systems Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Edward Farnworth
Research Associate
Institute of Ecology
University of Georgia
Athens, Georgia 30602

Dr. William P. Flatt
Professor and Director
Agricultural Experiment Station
College of Agriculture
University of Georgia
Athens, Georgia 30602

Dr. J. William Futrell
Professor
School of Law
University of Georgia
Athens, Georgia 30602

Mr. John R. George
Program Officer
Water Resources Division
U.S. Geological Survey
6481 Peachtree Industrial Blvd.
Doraville, Georgia 30340

Dr. Alice M. Harper
Assistant Professor
Chemistry Department
University of Georgia
Athens, Georgia 30602

Dr. Norman Herz
Professor and Head
Department of Geology
College of Arts and Sciences
University of Georgia
Athens, Georgia 30602

Dr. John D. Hewlett
Professor
School of Forest Resources
University of Georgia
Athens, Georgia 30602

Dr. Robert E. Hodson
Assistant Professor
Microbiology Department
University of Georgia
Athens, Georgia 30602

Dr. Harry P. Hopkins, Jr.
Associate Professor
Department of Chemistry
Georgia State University
Atlanta, Georgia 30303

Dr. Jerry S. Hubbard
Associate Professor
School of Biology
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Francis J. Johnston
Associate Professor
Department of Chemistry
University of Georgia
Athens, Georgia 30602

Dr. Ralph Leonard
USDA-SEA-FR
Southern Piedmont Conservation
Research Center
Watkinsville, Georgia 30677

Dr. Robert P. Lowell
Associate Professor
School of Geophysical Sciences
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Sheldon W. May
Associate Professor
School of Chemistry
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Paul Mayer
Regents' Professor
School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. William J. Miller
Professor
Dairy Science Department
Livestock & Poultry Building
University of Georgia
Athens, Georgia 30602

Dr. Wesley N. Musser
Associate Professor
Agricultural Economics
312 Conner Hall
University of Georgia
Athens, Georgia 30602

Dr. John Noakes
Director
Center for Applied Isotope Studies
University of Georgia
Athens, Georgia 30602

Dr. Wade L. Nutter
Associate Professor
School of Forest Resources
University of Georgia
Athens, Georgia 30602

Dr. Bernard C. Patten
Professor
Department of Zoology
College of Arts and Sciences
University of Georgia
Athens, Georgia 30602

Dr. Henry F. Perkins
Professor
Department of Agronomy
College of Agriculture
University of Georgia
Athens, Georgia 30602

Dr. Frederick G. Pohland
Professor
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Atlanta, Georgia 30332

D. Charles O. Pollard, Jr.
Associate Professor
School of Geophysical Sciences
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Johannes H. Reuter
Associate Professor
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Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Peter G. Sassone
Associate Professor
College of Industrial Management
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. F. Michael Saunders
Associate Professor
School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Webb M. Smathers
Assistant Professor
Agricultural Economics Research
University of Georgia
Athens, Georgia 30602

Dr. Peter Sturrock
Professor
School of Chemistry
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Adrian Thomas
USDA-SEA-FR
Southern Piedmont Conservation
Research Center
Watkinsville, Georgia 30677

Table 4 (cont'd)

Dr. Wayne Tincher
Director
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Norman J. Wood
Professor and Head
Department of Economics
University of Georgia
Athens, Georgia 30602

Dr. Robert L. Todd
Research Associate
Institute of Ecology
University of Georgia
Athens, Georgia 30602

Table 5

List of Research Reports Published by the

ENVIRONMENTAL RESOURCES CENTER
Georgia Institute of Technology
Atlanta, Georgia 30332

WRC Number	Title	Out-of-Stock Information
0166	The State of the Art of Water Use and Waste Disposal in the Textile Industry (1950-66), by Leonard D. Jones and William L. Hyden, June 1966, 27 pp.	---
0266	The Effect of a Permeable Bed on Sediment Motion--Phase I: Seepage Force on Bed Particles, By C.S. Martin, June 1966, 60 pp. (B-004-GA).	---
0366	Survey of the Nature and Magnitude of the Water Research Needs of the Textile Industry of Georgia, by William L. Hyden, Douglas F. Becknell, and Telford E. Elders, June 1966, 27 pp. (A-010-GA).	---
0466	Seepage Flow Through an Earth Dam, by M.R. Carstens and George D. May, July 1966, 68 pp.	---
0566	Annual Report, Water Resources Research Activities under Public Law 88-379, Fiscal Year 1966, Water Resources Center, August 1966, 60 pp.	---
0167.5	(Reprint) Selected Chapters from Organization and Methodology for River Basin Planning, by C.E. Kindsvater, ed., 132 pp.	---
0267.5	(Reprint) Pilot Studies on the Anaerobic Treatment of Tannery Effluents, by W.E. Gates and Sun-Dar Lin, 20 pp.	---
0367.5	(Reprint) A Fresh-Water Canal as a Barrier to Salt-Water Intrusion, by S. Charmonman, M.R. Carstens, and G.D. May, 7 pp.	---
0467.5	(Reprint) Evolution of a Duned Bed Under Oscillatory Flow, by M.R. Carstens and F.M. Neilson, 7 pp.	---
0567	Salt-Water Intrusion Effect of a Fresh-Water Canal, by M.R. Carstens and George D. May, May 1967, 41 pp. (B-003-GA).	---
0667	Georgia Laws, Policies and Programs Pertaining to Water and Related Land Resources, by George R. Elmore, Jr., June 1967, 112 pp.	---
0767	Annual Report, Water Resources Research Activities under Public Law 88-379, Fiscal Year 1967, Water Resources Center, August 1967, 116 pp.	---

WRC Number	Title	Out-of-Stock Information
0867	The Movement of Micron-Size Particles Through a Sand Bed, by Jerry B.F. Champlin, December 1967, 106 pp.	---
0967	Diffusion of Particles by Turbulence: Effect of Particle Size, by Hirendra Majumdar and M.R. Carstens, December 1967, 102 pp.	---
0168	Hydraulic Investigations of Tainter Gates as Flow Measuring Devices, by Paul G. Mayer and Bruce R. Olmstead, April 1968, 103 pp.	---
0268	Metropolitan Planning and River Basin Planning: Some Interrelationships, by Guy J. Kelnhofer, Jr., July 1968, 218 pp. (B-009-GA).	---
0368	Annual Report, Water Resources Research Activities under Public Law 88-379, Fiscal Year 1968, Water Resources Center, August 1968, 101 pp.	---
0468	The Effect of Induced Turbulence on the Growth of Algae, by Lawrence W. Olinger, September 1968, 81 pp.	---
0568	The Effect of Turbulence on Bacterial Substrate Utilization, by John T. Marlar, December 1968, 110 pp.	---
0668	Development and Application of a Rational Water Quality Planning Model, by Benjamin C. Dysart, III, and William W. Hines, January 1969, 182 pp. (A-012-GA).	---
0868	Determination, Evaluation and Abatement of Color in Textile Plant Effluents, by R.K. Flege, December 1968, 59 pp. (B-012-GA).	---
0169	(Reprint) Potassium, Illite and the Ocean, by Charles E. Weaver, 16 pp.	---
0269	A Stochastic Model for the Response of Permanent Offshore Structures Subject to Soil Restraints and Wave Forces, by Billy L. Edge and Paul G. Mayer, April 1969, 203 pp.	P.B. No. 232-178 Paper copy, $7.25 Microfiche, $2.25
0369	The Relation of Ion Movement to Fine Particle Displacement in a Sand Bed, by Jerry B.F. Champlin, July 1969, 22 pp. (A-002-GA).	P.B. No. 187-521 Paper copy, $3.25 Microfiche, $2.25
0469	Radiotracer Study of Rapid Sand Filtration, by Thomas Fisher Craft, Jr., August 1969, 179 pp. (B-020-GA).	P.B. No. 187-522 Paper copy, $7.00 Microfiche, $2.25
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0780	Agricultural Water Demand Prediction Using Remote Sensing Technology for Georgia Water Resource Management, by J.R. Jensen, December 1980, 47 pp. (A-083-GA).	P.B. No. 81-184137 Paper copy, $8.00 Microfiche, $3.50
0880	Annual Report, Water Resources Research Activities in Georgia under Public Law 95-467, Fiscal Year 1980, Environmental Resources Center, December 1980, 111 pp.	---
0181	Estimating Flood Damages in the State of Georgia, by T.N. Debo, January 1981, 213 pp. (A-081-GA).	P.B. No. 81-198343 Paper copy, $18.50 Microfiche, $3.50

ERC Number	Title	Out-of-Stock Information
0281	Analysis of the Development of Shallow Groundwater Supplies by Pumping from Ponds, by M.M. Aral, T.W. Sturm and J.M. Fulford, February 1981, 89 pp. (A-089-GA).	P.B. No. 81-231904 Paper copy, $11.00 Microfiche, $ 3.50
0381	The Applicability of Large-Diameter Shallow Wells to a Coastal Plain Hydrogeologic Environment, Georgia, by Barry F. Beck, November 1981, 37 pp. (A-085-GA).	P.B. No. 82-236621 Paper copy, $ 7.50 Microfiche, $ 4.00
0481	An Evaluation of the Potential for Water Conservation and Reuse in the Georgia Pulp and Paper Industry, by G.M. Battaglia, E.M. Hartley, W.B. Himes, G.E. Valentine, and J.C. Wyvill, June 1981, 71 pp. (C 90303-C).	P.B. No. 82-157991 Paper copy, $10.50 Microfiche, $ 4.00
0581	Retention of Urban Derived Phosphorus by an Alluvial Swamp of the Coastal Plain of Georgia, by William L. Tietjen and Jack C. Carter, July 1981, 76 pp. (A-084-GA).	P.B. No. 82-224635 Paper copy, $10.40 Microfiche, $ 4.00
0681	Environmental Impact of Upland Streams on the Okefenokee Swamp, by Elizabeth R. Blood, September 1981, 190 pp. (B-138-GA).	P.B. No. 82-243569 Paper copy, $18.00 Microfiche, $ 4.00
0781	Effects of Urbanization on Stream Ecosystems, by A.C. Benke, G.E. Willeke, F.K. Parrish and D.L. Stites, November 1981, 69 pp. (A-055-GA).	P.B. No. 82-254905 Paper copy, $ 9.00 Microfiche, $ 4.00
0881	Annual Report, Water Resources Research Activities in Georgia under Public Law 95-467, Fiscal Year 1981, Environmental Resources Center, December 1981, 97 pp.	
0182	Valuation and Acquisition of Floodplain Lands for Stream Valley Parks, by Charles F. Floyd, June 1982, 75 pp. (B-127-GA).	
0282	Microbial Degradation of Natural and Pollutionally-derived Lignocellulosic Detritus in Wetland Ecosystems, by R.E. Hodson and A.E. Maccubbin, August 1982, 44 pp. (A-082-GA).	
0382	Application of Electrochemical Detectors for Improved Sensitivity in High Performance Liquid Chromatographic Separation and Quantitation of Ultratrace Pesticide and Coal Phenolic Residues in Water, by James L. Anderson, July 1982, 34 pp. (A-090-GA).	
0482	The Implications of Productivity in Assessing Ecological Impact in the Tidewater Zone of a Coastal Plain Stream, by David M. Gillespie, August 1982, 57 pp. (A-065-GA).	

ERC Number	Title	Out-of-Stock Information
0582	Prediction of Irrigation Water Demands in the Southeastern United States, by J.L. Chesness and D.L. Cochran, June 1982, 30 pp. (B-146-GA).	
0682	Permitting Options and Design Procedure for a Controlled-discharge Wastewater Treatment Facility, by Kathryn J. Hatcher, August 1982, 120 pp. (A-087-GA).	
0782	Effects of Alternative Cost Sharing Arrangements on State Water Resources Investments, by R.M. North and K.J. Hatcher, August 1982, 85 pp. (B-142-GA).	
0882	Organic Solvent Regeneration of Granular Activated Carbon, by W.H. Cross, M.T. Suidan, M.A. Rollor, B.R. Kim, and J.P. Gould, September 1982, 261 pp. (B-141-GA).	
0982	Predicting the Specific Capacities of Wells Penetrating the Ocala Aquifer Beneath the Dougherty Plain, Southwest Georgia, by G.A. Brook and C. Sun, September 1982, 86 pp. (A-086-GA).	
1082	Irrigation System Efficiency Survey for Georgia, by J.R. Stansell, C. Butts, K. Harrison, and J. Garner, October 1982, 32 pp. (A-102-GA).	
1182	Detection of Iodine Species in Dilute Aqueous Solutions and the Modification of the Physical and Chemical Properties of Iodide Salts with Macrocyclic Multidentate Ligands, by C.L. Liotta, R.C. McFarland, and M.B. Bruce, November 1982, 23 pp. (A-074-GA).	
1282	Annual Report, Water Resources Research Activities in Georgia under Public Law 95-467, Fiscal Year 1982, Environmental Resources Center, December 1982, 91 pp.	

PART II

ANNUAL COOPERATIVE PROGRAM

WATER RESOURCES RESEARCH PROGRAM UNDER PUBLIC LAW 95-467

OFFICE OF WATER POLICY--U.S. DEPARTMENT OF THE INTERIOR

PROJECT NUMBER	PROJECT TITLE	PRINCIPAL INVESTIGATOR
	Projects Active During FY 1982	
A-065-GA	"The Implications of Productivity in Assessing Ecological Impact in the Tidewater Zone of a Coastal Plain Stream"	D.M. Gillespie, Marine Extension Service, University of Georgia
A-082-GA	"Microbial Degradation of Natural and Pollutionally-derived Lignocellulosic Detritus in Wetland Ecosystems"	R.E. Hodson, Department of Microbiology, University of Georgia
A-086-GA	"Relationship Between Lineaments and Groundwater Flow in the Southwest Georgia Aquifer"	G.A. Brook, Department of Geography, University of Georgia
A-087-GA	"Least Cost Wastewater Management Alternatives for Discharges into Small Ungaged Streams"	K.J. Hatcher, Institute of Natural Resources, University of Georgia
A-088-GA	"Identification and Assessment of Effluent Residuals in Treated Leachate from Landfill Disposal Sites"	F.G. Pohland, School of Civil Engineering, Georgia Tech
A-090-GA	"Application of Electrochemical Detectors for Improved Sensitivity in High Performance Liquid Chromatographic Separation and Separation and Quantitation of Ultratrace Pesticide and Coal Phenolic Residues in Water"	J.L. Anderson, Department of Chemistry, University of Georgia
A-091-GA	"Aquifer Parameter Prediction by Numerical Modeling"	M.M. Aral, School of Civil Engineering, Georgia Tech
A-092-GA	"The Application of Kaolin for Control of Heavy Metal Toxicity in Anaerobic Sludge Digestion"	W.H. Cross, School of Civil Engineering, Georgia Tech
A-095-GA	"Kinetic Model for Ozonation of Toxic Water Contaminants"	F.M. Saunders, School of Civil Engineering, Georgia Tech

PROJECT NUMBER	PROJECT TITLE	PRINCIPAL INVESTIGATOR
A-097-GA	"Comparative Study of the Causes and Effects of Recent Southeastern Droughts"	C.G. Justus, School of Geophysical Sciences, Georgia Tech
A-100-GA	"Production of a Film on Georgia's Water Resources"	J.E. Kundell, Institute of Government, University of Georgia
A-101-GA	"Water Resources and Wetlands: A Survey of the Law in Georgia"	J.O. Smith, Institute of Natural Resources, University of Georgia
A-102-GA	"Irrigation System Efficiency Survey for Georgia"	J.R. Stansell, Agricultural Enginering Department, University of Georgia
A-103-GA	"Basin Scale Evapotranspiration Determination Through Watershed and Climate Analysis"	L. A. Harper, Southern Piedmont Conservation Research Center, University of Georgia

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-065-GA

AGREEMENT NO. 14-34-0001- 5010

FCCSET RESEARCH CATEGORY: 6G

PROJECT TITLE:

The Implications of Productivity in Assessing Ecological Impact in the Tidewater Zone of a Coastal Plain Stream.

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology, Atlanta, Georgia 30332
And
University of Georgia Marine Extension Center, Savannah, Georgia 31406

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: July ; YEAR: 1975	MONTH: November ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
David M. Gillespie	Ph.D.	Aquatic Ecology

STUDENT ASSISTANTS[1]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Kristen Turgeon	B.S.	Biology
James C. Hodges	B.S., M.S.	Biology
Robert Henry	B.S.	Biology
Arthur Smart	B.S.	Computer Science

Research Project Accomplishments. Sampling in the tidewater zone of the Satilla River was begun in July, 1975, and continued through December, 1976. Samples were obtained on eleven dates during this period, and attempts to sample on several dates were frustrated by bad weather or equipment failure. Approximately 350 biological samples have been obtained including ponar grab samples of sandy and muddy benthos and Clarke-Bumpus plankton samples. In addition, approximately 200 water samples have been obtained for salinity analysis. Benthos samples were sorted, separated from debris and the dominant organisms identified. Organisms which were not immediately identifiable were sent to experts for determination. Number of organisms and biomass of each species were determined for each sample, and calculation of production of the benthic organisms has begun. Plankton samples were counted and organisms identified, and biomass and productivity were determined. Analyses of samples showed that the tidewater zone is relatively low in species number, numbers of individuals, biomass and productivity. Salinities have been determined for surface and bottom water at each site as a means of determining the penetration and distribution of sea water in the esturay. The water in the channel seems well-mixed, with little or no difference between surface and bottom salinities. The salinity gradient shifts up and down the channel over several miles, responding to river discharge and tide levels. At low river flows, salt water is detectable for at least 22 miles upstream from the sea. Since the distribution of contaminants in the estuary can be directly inferred from the distribution and mixing pattern of sea water, it is apparent that any contaminants introduced into the estuary can be expected to be distributed at least 22 miles upstream.

Publications

No major publications have appeared based primarily on the present project. An invited paper was presented at the 1977 national meeting of the North American Benthological Society, using data from this and a related project. A paper was also submitted for the 1978 meeting of the Southeastern Estuarine Research Society.

Project Status

Final Report draft submitted, final revision of manuscript will be ready by November 1, 1982.

Application of Research Results

Preliminary results have been communicated to the planning and research section of the Georgia Department of Natural Resources. These have been used in the preparation of plans and research proposals concerning resource development in coastal and offshore areas of Georgia. Project personnel have participated in conferences and workshops, and in the preparation and evaluation of research proposals.

Work Remaining and Progress Contemplated During the Next Year

Final report anticipated by November, 1982.

Form CW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-082-GA

AGREEMENT NO. 14-34-0001- 9011

FCCSET RESEARCH CATEGORY: 05B

PROJECT TITLE: MICROBIAL DEGRADATION OF NATURAL AND POLLUTIONALLY-DERIVED LIGNOCELLULOSIC DETRITUS IN WETLAND ECOSYSTEMS

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia, Athens, Georgia

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: October ; YEAR: 1978	MONTH: December ; YEAR: 1981

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Robert E. Hodson	Ph.D.	Microbiology/Ecology
A.E. Maccubbin	Ph.D.	Microbiology/Marine Biology

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
James P. Shapleigh	M.S.	Microbiology
Ellen Siekmann	M.S.	Microbiology

(A) RESEARCH PROJECT ACCOMPLISHMENTS

Our primary goal in this project was to develop and apply methodology to assess rates of microbial transformation of the structural components of freshwater and estuarine wetland plants. As in most vascular plants, these plants are composed largely of the macromolecular complex, lignocellulose, which is a combination of lignin, cellulose, and hemicellulose associated *via* close physical contact and some degree of covalent bonding. Relative to other plant components, this material is highly resistant to microbial degradation. Because of the very slow rates of microbial transformation of lignocellulose, most methods for following the fate of organic molecules in aquatic environments are not applicable to lignocellulose. However, its quantitative significance in a variety of aquatic plants was determined by us to be high (50-90 percent of dry wt.) depending on species. Thus, lignocellulose is potentially a very important source of organic carbon and energy for aquatic animals. However, animals, with few exceptions, cannot digest lignocellulose efficiently. Only a few animals can assimilate the cellulosic moiety of lignocellulose, and no animals are known to utilize the lignin moiety.

Microorganisms are the only life forms which can effectively degrade lignocellulose. The plant biomass in wetland environments is not grazed heavily by animals while it is living. Instead, it dies, falls into the water and is exposed to long-term degradation by the aquatic microflora. The microbial biomass that grows at the expense of the plant lignocellulose serves, then, as a highly nutritive food source for the animals of the wetland. Thus, microbial transformation of the refractory lignocellulose serves as a principal link between primary and secondary production in wetlands.

During this project, we developed a method for specifically radiolabelling both the lignin and the cellulosic moieties of plant lignocelluloses. The labelled material can be used in experiments to follow rates of lignocellulose mineralization to carbon dioxide, solubilization to dissolved organic compounds, and assimilation into microbial biomass. To label the cellulose moiety, plant cuttings are exposed to 14C-D-glucose; to label the lignin moiety, the cuttings are exposed to 14C-cinnamic acid, 14C-L-phenylalanine, or 14C-L-tyrosine. The cuttings are allowed to take up and metabolize the radiolabelled compounds for several days, then they are dried, ground to uniform particle size and extracted to remove non-lignocellulosic components. The resulting extractive-free lignocellulose is then analyzed to determine the distribution of the label. Much effort and time went into maximizing the specific activity attainable with this procedure using aquatic plants and minimizing cross-labelling of lignin and cellulose or labelling of non-lignocellulosic compounds. Today we have the ability to effectively radiolabel a wide variety of freshwater and marine vascular plants such as the salt marsh cordgrass, Spartina alterniflora , the salt marsh rush, Juncus roemerianus , several species of mangroves, several species of the sedge, Carex , the swamp grass, Panicum sp. ,and a number of herbaceous plants such

as waterlilies.

Long-term incubations of the radiolabelled lignocelluloses with natural water or sediment samples from salt marshes and from the Okefenokee Swamp consistently indicated that the cellulose moiety is degraded faster than the lignin moiety, resulting in the detrital material becoming progressively more enriched in lignin over time. This change in composition results in the detrital material becoming more refractory to further microbial degradation. We also see very large differences in the relative rates of mineralization of different plant lignocelluloses. Pine lignocellulose, for instance, was degraded by salt marsh microflora ten times more slowly than lignocellulose from S. alterniflora . In addition to the production of carbon dioxide, lignocellulose degradation also results in the production of labelled methane under anaerobic incubation conditions. We are presently modifying the procedures to determine what, if any, other substances result from lignocellulose decomposition by aquatic microflora.

(B) APPLICATION OF RESEARCH RESULTS

The national Science Foundation expressed great interest in the radiolabelling procedures developed during this OWRT project. Upon presenting a brief summary of our preliminary findings, I was asked to prepare a formal proposal for funding consideration. Subsequently, NSF awarded us a sizable grant to continue with certain marine aspects of our project. The International Biodeterioration Society also is quite excited about the findings and has included a chapter in the next book on biodeterioration about our work.

The technique we developed for following rates of decomposition of natural

lignocellulosic detrital material in aquatic environments also has utility for labelling and following the fate of pollutionally-derived plant materials in aquatic systems. We have had questions put to us by a number of pulp and paper manufacturing companies for instance. In the lab we have successfully prepared 14C-labelled Kraft Mill lignins and followed their decomposition in wetland soils and water samples. The same techniques can be applied to prepare pulp lignins using new, experimental procedures that are currently being evaluated for possible future adoption by the pulping industry. In this way, we can determine the toxicity of these new effluents and the rate at which they would be turned over (decomposed) by the microflora of the receiving waters and sediments.

(C) PUBLICATIONS

HODSON,R.E., R.BENNER, and A.E. MACCUBBIN. 1982. Microbial mineralization of lignocellulose in marine environments. In (T.A. Oxley, ed.) Biodeterioration V. John Wiley and Sons. In Press.

MACCUBBIN, A.E., R. BENNER, and R.E. HODSON. 1982. Kinetics of microbial degradation of organic pulp mill effluents in marine environments. In (T.A. Oxley, ed.)Biodeterioration V. John Wiley and Sons. In Press.

HODSON, R.E., R.R. CHRISTIAN, and A.E. MACCUBBIN. 1982. Lignin and lignocellulose in Spartina alterniflora : Initial composition and immediate post-depositional changes in detritus composition. Marine Biology. Submitted.

HODSON, R.E., A.E. MACCUBBIN, R. BENNER, and R. MURRAY. 1982. Microbial transformations of detrital organic carbon in wetland ecosystems: effects of

environmental stress. In (J. Larsen, ed.) Ecological considerations in wetlands treatment of municipal wastewater. Academic Press. In Press.

MACCUBBIN, A.E., and R.E. HODSON 1980. Mineralization of detrital lignocelluloses by salt marsh sediment microflora. Appl. Env. Microbiol. 40 :735-740.

(D) PROJECT STATUS

The project has been completed. No further funded work is scheduled. However, we have been so encouraged by the results of this preliminary project, we hope to secure funding for continued research support from one or another agency. We feel that we can get matching funds, or other additional research support from the pulp and paper industry which is very interested in our results.

A project completion report has been prepared, approved by the sponsoring institutes, and is currently being printed for distribution. It should be available by mid January, 1983.

(E) WORK REMAINING AND PROGRESS CONTEMPLATED DURING NEXT YEAR

Since the project's initial funding period has expired, we contemplate no further work at this time. Certain aspects of the project are being carried on under the sponsorship of other granting agencies with additional support from a private foundation in Savannah, Georgia (Herty Foundation) which conducts research for the pulping industry.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-086-GA

AGREEMENT NO. 14-34-0001-0111

FCCSET RESEARCH CATEGORY: 2F

PROJECT TITLE:

Relationship Between Lineaments and Groundwater Flow in the Southwest Georgia Aquifer

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia, Athens, Georgia 30602

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: November ; YEAR: 1979	MONTH: October ; YEAR: 1981

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
George A. Brook	Ph.D.	Geography
Robert E. Carver	Ph.D.	Geology

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Terry Lee Allison	M.A.	Geography, specializing in geomorphology and remote sensing
Grady Tuell	B.S.	Geography
Ching-Hong Sun	M.A.	Geography specializing in geomorphology and quantitative methods

RESEARCH PROJECT ACCOMPLISHMENTS.

The aim of this study was to examine relationships between well specific capacity (gpm/ft) and fracture trace and topographic characteristics in the Dougherty Plain topographic region of southwest Georgia. Specific capacity data were obtained for 39 wells. The following conclusions have been drawn from our studies of the Dougherty Plain.

1) LANDSAT and SKYLAB images may be useful for large-scale lineament analysis but they are not suitable for fracture trace mapping in the Dougherty Plain of Georgia. The most detailed fracture trace maps can be prepared from low altitude black and white photographs (scale 1:20,000). Approximately 81% of fracture traces visible on low altitude photographs can also be mapped from medium altitude black and white photographs (scale 1:59,000). Medium altitude black and white photographs are therefore recommended for fracture trace mapping in relatively large areas such as a county. Low altitude black and white photographs are recommended for fracture trace mapping in smaller areas such as industrial sites or large farms. Both types of photography are available for the entire Dougherty Plain region of Georgia.

2) Within the Dougherty Plain, well specific capacities are significantly higher when wells are located within a zone extending for 97 feet on either side of a fracture trace. The mean specific capacity of the 18 fracture trace wells examined was 435 gpm/ft, the mean of the 21 nonfracture trace wells was 85 gpm/ft.

3) The model recommended for use in predicting fracture trace well specific capacity is:

$$\text{Log}_e\ (\text{SPECA}) = 5.75 - 0.0129\ (\text{DISTL}) + 0.0144\ (\text{INTNO}) + 0.00015\ (\text{CLOLEN})$$

where SPECA is specific capacity in gpm/ft, DISTL is the distance in feet from the well to the nearest fracture trace, INTNO is the number of fracture trace intersections per mi^2 in the area around the well, and CLOLEN is the length in feet of the fracture trace on which the well is located. This model explains 77% of the variation in fracture trace well SPECA.

4) A single variable DISTL 2, which is equal to DISTL or DISIK (the distance in feet to the center of the closest sinkhole) whichever is smaller, explains 82% of the variance in nonfracture trace well SPECA. The least squares model is:

$$\text{Log}_e\ (\text{SPECA}) = 5.19 - 0.0033\ (\text{DISTL 2}),$$

where SPECA is in gpm/ft and DISTL 2 in feet. DISTL 2 is considered to be a better predictor of nonfracture trace well SPECA than DISTL because it incorporates the possibility that sinkholes closer to a well than the nearest mapped fracture trace may mark the locations of unmapped bedrock fracture concentration zones for which there is very little surface evidence. This model is recommended for use in predicting nonfracture trace well SPECA.

5) A principal components analysis of the 11 sinkhole and fracture trace variables, and of the 7 fracture variables alone, isolated a small number of hydrogeologically meaningful components from the fracture trace well and nonfracture trace well data sets, which explain a large proportion of the variance in the data. Multiple regression analysis of the significant components produced predictive models explaining up to 79% of the variance in fracture trace well SPECA and 80% of the variance in nonfracture trace well SPECA. More important than the degree of statistical explanation of SPECA afforded by these models, however, is the information they provide about the hydrogeological factors which influence SPECA.

It is clear from the results that only one environmental factor, DISTL, influences the SPECA of a nonfracture trace well. This indicates that the secondary permeability of the Ocala limestone, and therefore the groundwater flow velocity, decreases with increasing distance from a fracture concentration zone. The SPECA of wells which penetrate fracture concentration zones are influenced by DISTL and also by the distance to the nearest fracture trace intersection (DISINT). This implies that secondary permeabilities and groundwater flow velocities are greater at the center of fracture concentration zones and at fracture zone intersections. Fracture trace well SPECA is also affected by the length of the closest fracture trace (CLOLEN) and by the total length of fracture traces forming the closest fracture trace intersection (FRASI). SPECA increases as these two variables increase. This indicates that secondary permeabilities and groundwater flow velocities are higher in the longer fracture concentration zones than in the shorter ones. Therefore, the best sites for high specific wells are on long fracture traces, or better still, at intersections formed by long fracture traces.

6) The techniques employed and models developed in this study can be used to locate high specific capacity wells in the Dougherty Plain. This could reduce pumping costs for both agricultural, industrial, and residential uses of groundwater extracted from the Ocala aquifer.

APPLICATION OF RESEARCH RESULTS.

The models developed to predict well specific capacity can be applied to practical situations by water resource and land use planners and by water well drilling companies.

PUBLICATIONS.

(1) Allison, T. L. (1980). Modelling sinkhole susceptibility in Dougherty County, Georgia, from sinkhole and fracture distribution data.- M.A. Thesis. Univ. of Georgia, 108 pp. (supervised by George A. Brook).

(2) Brook, G. A. and Allison, T. L. (1981). Subsidence susceptibility models for Dougherty County, Georgia, from sinkhole and fracture distribution data. Proceedings of the Eighth International Congress of Speleology, v. 1, 50-52 (Bowling Green, U.S.A.).

(3) Brook, G. A. and Allison, T. L. (1982). Fracture mapping in covered karst terrain and application of a geographic information system to ground subsistence susceptability modelling: the example of Dougherty County, Georgia. To be published in a book "Environmental Karst" edited by P. H. Dougherty, Strathmere Press 1982.

(4) Brook, G. A. and Tuell, G. (1978). Fracture mapping in mantled karst. Southeastern Division Assoc. Amer. Geogr. Annual Conference. Abstracts with Programs, p. 12.

(5) Sun, C-H and Brook, G. A. (1981). Relationship between fracture traces and well specific capacity in the Dougherty Plain, Southwest Georgia. Southeastern Division Assoc. Amer. Geogr. Annual Conference. Abstracts with Programs p. 61.

(6) Sun, C-H (1981). Relationship between fracture traces and ground water flow in the southwest Georgia aquifer. M.A. Thesis. Univ. of Georgia, 120 pp. (supervised by George A. Brook).

PROJECT STATUS:

The final completion report Brook, G. A. and Sun, C-H (1982). Predicting the Specific Capacities of Wells Penetrating the Ocala Aquifer Beneath the Dougherty Plain, Southwest Georgia, E.R.C. 09-82, 86 pp. is now available.

WORK REMAINING AND PROGRESS CONTEMPLATED DURING NEXT YEAR

Although all research and the final report has been completed we will be submitting two manuscripts for publication in refereed journals in late 1982 to early 1983.

Form CW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-087-GA

AGREEMENT NO. 14-34-0001-0111

FCCSET RESEARCH CATEGORY: 5D

PROJECT TITLE:

Least Cost Wastewater Management Alternatives for Discharges into Small Ungaged Streams

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Institute of Natural Resources
University of Georgia
Athens, Georgia 30602

PROJECT BEGAN -- MONTH: November ; YEAR: 1979

TO BE COMPLETED -- MONTH: October ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Kathryn J. Hatcher	S.M.C.E.	Civil Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Charles M. McPherson	B.S.	Environ. Health Science

A. Research Project Accomplishments.

Many communities and industries are faced with high wastewater treatment costs because they discharge into small streams having low natural streamflow and little wastewater dilution capacity during the dry season. To meet stream quality standards, these dischargers must either build expensive advanced wastewater treatment facilities or consider several less conventional, possibly cheaper alternatives such as holding a lower quality wastewater in storage ponds during the dry season, or land application of the wastewater, or some combination of alternatives. This research project can assist the design

engineer in identifying and evaluating these less conventional waste treatment facility designs to find the facility design which will maintain the receiving stream's water quality standard at the least cost.

First, this research has developed an analytical design procedure to help the engineer quickly screen the set of all alternative designs which include some combination of wastewater treatment lagoons, a wastewater holding pond, and land application site.

Two key elements in the facility design task are (1) correctly sizing the different treatment facility components including the pre-treatment lagoons, the wastewater holding pond, and the land application site, and (2) selecting an appropriate effluent release schedule for the wastewater holding pond. The research products to assist these facility design tasks are:

(1) a computer program for optimally sizing certain facility components, including pre-treatment lagoons, wastewater storage pond, and land application site,
(2) an illustration of the computer-assisted analytical design procedure for a sample problem, and
(3) a description and evaluation of four effluent release schedules for the wastewater holding pond.

B. Application of Research Results.

The research results for the analytical design procedure will be useful to consulting engineering firms and governmental agencies that deal with wastewater treatment facility designs.

C. Publications.

(1) Hatcher, Kathryn J., "Finding Design Criteria and Operating Schedules for a Wastewater Storage Pond," in Proceedings of the Symposium on Surface Water Impoundments (June 2-5, 1980, Minneapolis, Minnesota), edited by Heinz Stefan, American Society of Engineers, 1981, pp. 1209-1226.

(2) Hatcher, Kathryn J., "Best Discharge Schedules for Wastewater Storage Ponds," paper presented at the Fiftieth Annual Conference of the Georgia Water and Pollution Control Association, August 9-12, 1981; Atlanta, Ga.

(3) Hatcher, Kathryn J., "Evaluation of Hydrograph-Controlled Permit Criteria for Waste Stabilization Ponds," in 1982 National Conference on Environmental Engineering, Proceedings of the American Society of Engineers Environmental Engineering Division, Minneapolis, Minnesota, July 14-16, 1982, pp. 707-711.

D. Project Status. Completed.

E. Work Remaining and Progress Comtemplated During Next Year.

No work is remaining for this project. However, the principal investigator will continue developing lines of research that were initiated under this project. Tasks planned for next year include:

(1) defining a correct statistical procedure for determining a set of design monthly low streamflow values that will have the same risk level as the conventional "7-day, 10-year" minimum streamflow;

(2) maintaining and updating the facility simulation model as new research results become available;

(3) providing tape or disk copies of the computer program and, as time permits, assistance to users in applying the facility simulation model.

Form OWI-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-088-GA

AGREEMENT NO. 14-34-0001-0111

FCCSET RESEARCH CATEGORY: 5A

PROJECT TITLE:

"Identification and Assessment of Effluent Residuals in Treated Leachate from Landfill Disposal Sites"

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN -- MONTH: October ; YEAR: 1979

TO BE COMPLETED -- MONTH: December ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Frederick G. Pohland	Ph.D	Environmental Engineering
Joseph P. Gould	Ph.D.	Environmental Engineering
Edward S. K. Chian	Sc.D.	Biochemical Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
R. Elizabeth Ramsey	B.S.	Environmental Science
Kenneth Collins		Chemical Engineer

A. Research Project Accomplishments. During the initial phase of the research effort, the analytical protocol to be used for analysis of selected organic fractions of landfill leachates was developed. This protocol included the following analytical techniques:

a. A modification of the hydroxylamine method of Montgomery, et al. (1) for the determination of total carboxyl groups.

b. The Folin-Denis technique (2) as modified by Standard Methods (3) for the determination of aromatic hydroxyl groups.

c. The ninhydrin method developed by Moore and Stein (4), modified for the determination of proteins.

d. The phenol-sulfuric acid method (5) for the determination of carbohydrates.

e. Gas chromatography for the determination of volatile organic acids.

f. Standard Methods (3) techniques, augmented with a TOC analyzer for the determination of total organic carbon.

g. Standard Methods (3) techniques, augmented with respirometer tests, for the determination of biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

These analyses were subsequently used over an experimental period of about two years to assess the characteristics of leachate samples collected from simulated landfill cells located on the campus of the Georgia Institute of Technology. These data are currently being compiled and evaluated within the perspective of landfill operating conditions and changes in leachate quality and quantity with time as determined by other complementary physical and chemical analyses.

Under the influences of leachate containment and recycle through the lysimeter columns, preliminary data inspection has revealed that while the BOD/COD ratio has remained relatively constant at about 50% throughout the experimental investigations, the nature of the organic composition reflected by these analyses, but measured more specifically with some of the aforementioned analytical techniques, has changed with time. These changes are presently being evaluated to help interpret the sequence of processes responsible for leachate production and/or quality variations. Analysis of these observations will be included in the final project report presently being prepared.

The analyses of leachate samples for selected organic constituents has been augmented with concurrent chlorination studies to emphasize the relative implications of applying such a disinfection technique in practice. Doses of chlorine ranging above 400 mg/l were required to satisfy the chlorine demand of leachate samples. Such a dosage resulted indramatic reductions in organism counts, tended to reduce the chemical oxygen demand (COD) of the leachate, but led to the production of more than twenty volatile halogenated compounds. The nature and concentration of these halogenated organic species continue to be assessed, but GC-MS evaluations indicate that trihalomethanes (THMs) in excess of 500 ppb were formed. The

result of this effort has been reported in part at the Fourth Conference on Water chlorination in Asilomar, California in October 1981 (see Publications).

Since the simulated landfill cells were constructed and operated to study the changes in leachate characteristics from the codisposal of municipal solid wastes and differing amounts of industrial (metal plating) wastes, the nature and variation of organic constituents identified during these research investigations have been dependent upon the impacts of the metal plating sludges on the normal sequence of microbially mediated conversion processes within the landfill environment. Of particular importance in the final analysis has been the presence and mobility of the heavy metals, their ability to precipitate as sulfides after sulfate reduction, and their possible inhibitory influences due to metal toxicity. This imposition on the normal processes of stabilization occurring in conventional landfill disposal sites has complicated the data analysis, but preliminary assessment has indicated that concentrations of organic species follow corresponding stabilization trends. Inspection of these observations continues and more detailed discussion of their role and significance during landfill disposal operations will be included in the final report.

References:

(1) Montgomery, H. A. C., et al., "The Rapid Colorimetric Determination of Organic Acids and their Salts in Sewage Sludge Liquor, The Analyst, 87, 949 (1962).

(2) Folin, O., and Denis, W., "On Phosphotungstic - Phosphomolybdic Compounds as Color Reagents," Jour. Biol. Chem., 12, 239 (1912).

(3) APHA, AWWA, WPCF, Standard Methods for the Examination of Water and Wastewater, 14th Edition, 1975.

(4) Moore, S., and Stein, W. A., "Photometric Ninhydrin Method for use in the Chromatography of Amino Acids," Jour. Biol. Chem., 176, 367 (1948).

(5) Gotterman, H. L., and Clymo, R. S., "Methods for Chemical Analysis of Fresh Waters," International Biological Programme Handbook No. 8, Blackwell Scientific Publishers, Oxford, G. B. (1969).

B. Application of Research Results. Since the results of this research effort have not been fully evaluated, their potential for effective application has not been totally realized. However, the problems with hazardous wastes and leaching from landfills is a very crucial environmental issue which can be better resolved with information of the type to be obtained from the present research effort. Moreover, the results have indicated that normal landfill stabilization can be adversely influenced by the presence of inhibitors, thus prolonging the possibility of adverse environmental impact. In addition, the investigations with disinfection clearly illustrate that such a polishing procedure with chlorine on treated (or untreated) leachates would produce many objectionable halogenated organic constituents. Therefore, the results will collectively contribute to better understanding and development of more technically sound landfill design and management procedures.

C. Publications. A portion of the results obtained in these investigations has been presented and appears in the following three publications.

"Formation of Volatile Haloorganic Compounds in the Chlorination of Municipal Landfill Leachates", in Water Chlorination: Environmental Impacts and Health Effects, Gould, J. P., Ramsey, R. E., Giabbai, M. and Pohland, F. G., Volume 4, Chapter 36, 525-539, Ann Arbor Science, 1982.

"The Behavior of Heavy Metals During Landfill Disposal of Hazardous Wastes", Pohland, F. G., Gould, J. P., Ramsey, R. E. and Walters, D. C., Proceedings Eight Annual Research Symposium: Land Disposal of Hazardous Wastes, EPA-600/9-82-002, 360-371, March 1982.

"Controlled Landfill Stabilization by Leachate Recirculation", Pohland, F. G., Final Report, EPA Project R-803953, 149 pp, September 1982.

D. Project Status. The experimental effort embraced by the research project has been completed and a final project report is being prepared.

E. Work Remaining and Progress Contemplated During Next Year. As indicated previously, the remaining effort will be devoted to final data analysis and preparation of a final report.

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-090-GA

AGREEMENT NO. 14-34-0001- 1111

FCCSET RESEARCH CATEGORY: 05A

PROJECT TITLE:

Application of Electrochemical Detectors for Improved Sensitivity in High Performance Liqui Chromatographic Separation and Quantitation c Ultratrace Pesticide and Coal Phenolic Residue in Water

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Department of Chemistry
University of Georgia
Athens, Georgia 30602

PROJECT BEGAN -- MONTH: October ; YEAR: 1980

TO BE COMPLETED -- MONTH: December ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
James L. Anderson	Ph.D.	Chemistry

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Michael Golden	B.S.	Chemistry
Randal Hall	B.S.	Chemistry

(A) Research Accomplishments

Electrochemical detectors based on Kel-F-graphite ("Kelgraf") composite working electrode material were developed and applied for liquid chromatographic detection of selected pesticides in the carbamate and urea classes at ultratrace levels in water. Detection limits as low as 50 picograms were achieved for selected carbamate pesticides including Aminocarb and Carbendazin in river water. These detection limits are markedly superior (typically at least 20-fold) to values reported to date by other workers for electrochemical or any other detectors for liquid chromatography. In general, species electrochemically oxidizable with formal potentials less than + 1.1V vs. Ag/AgCl exhibit detection limits in subnanogram range. Work on characterization of the Kelgraf electrode revealed that its microparticulate surface structure with islands of graphite active sites surrounded by Kel-F plays an important role in minimizing interference from solvent oxidation current fluctuations, enabling very favorable detection limits to be achieved at the very positive applied potentials used in this work. The electrode structure shows promise for improving detection limits for a wide range of anaytes including many not investigated here. A very effective, rapid approach was developed and tested for off-line estimation from a single cyclic voltammogram of the optimum applied potential for an electrochemical flow detector under chromatographic conditions. An improved electrochemical cell design was developed and tested for rapid kinetic measurements on electrochemical systems of interest.

(B) Application of Research Results

Other workers in the field have requested journal article reprints indicating considerable interest in our methodology and results by the national research community. A company specializing in environmental analysis, ESA Associates of Bedford, Massachusetts, has samples of our Kelgraf electrode material for evaluation in one of their applications. Discussions with personnel of the Georgia Department of Natural Resources Water Laboratory were held to assess possible application of our results to their water quality problems.

(C) Publications

Four journal articles were published in 1980-81. Four additional articles were submitted for publication in 1982. The final Completion report: J. L. Anderson, "Application of Electrochemical Detectors for Improved Sensitivity in High Performance Liquid Chromatographic Separation and Quantification of Ultratrace Pesticide and Coal Phenolic Residues in Water." ERC 03-82. Department of Chemistry University of Georgia, Athens, GA 30602. July 1982. 34 pgs.

(D) Project Status. The project has been completed. A completion report was submitted in December, 1982.

(E) Work Remaining and Progress Contemplated During Next Year. Project Completed.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-091-GA

AGREEMENT NO. 14-34-0001- 1111

FCCSET RESEARCH CATEGORY: 2F, 7B

PROJECT TITLE:

Aquifer Parameter Prediction by Numerical Modeling

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: 1 ; YEAR: 1981	MONTH: 3 ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Dr. M.M. Aral	Ph.D.	Civil Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Eve Kunianski	B.S.	Civil Engineering

Research Project Accomplishments

Work on this project has been completed except for the final report. The proposed research involved the generation of a mathematical and a numerical model which may be used in predicting aquifer parameters in non-leaky confined aquifers. Thus, an inverse problem is formulated where the aquifer parameters are solved for, given the steady state equations of motion for non-leaky aquifers and a set of observation data for non-leaky aquifers. Two models are investigated, the first model can be described as the direct solution of the inverse problem and the second one can be identified as the indirect solution of the inverse problem. Several problems are studied utilizing these techniques and these will be presented in the final report with comparisons.

Application of Research Results

The numerical model developed is used to predict the transmissivity parameters in Dougherty Plain aquifer. Results obtained will be presented in the final report. This phase of the study is conducted in cooperation with Georgia Department of Natural Resources. Geologic and Water Resources Division.

Publications

None at this time.

Project Status

The project is completed at this time.

Work Remaining and Progress Contemplated During Next Year

Completion of final report.

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-092-GA

AGREEMENT NO. 14-34-0001-1111

FCCSET RESEARCH CATEGORY: V-D

PROJECT TITLE:

The Application of Kaolin for Control of Heavy Metal Toxicity in Anaerobic Sludge Digestion

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: January ; YEAR: 1981	MONTH: March 31 ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Dr. W. H. Cross	Ph.D.	Chemistry

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Pedro Rossello	B.S. M.S.	Civil Engineering Environmental Engineering
Christopher McGahey	B.S.	Civil Engineering

Research Project Accomplishments

Six laboratory-scale anaerobic digesters have been in operation for over 430 days to evaluate the impact of the presence of the heavy metals nickel, copper, chromium and zinc and to investigate the potential of adding kaolin as a fixing agent for the reduction of the heavy metal toxicity.

Three of the units have been fed raw sludge, raw sludge plus kaolin, and raw sludge plus metals, respectively, while the other three units have been fed a mixture of raw sludge, kaolin and increasing concentrations of metals. The metals concentration fed to each unit was increased gradually until a decrease in biological activity or ultimately digester failure was observed.

High metal concentrations were attained in each digester before failure occurred. Toxicity was definitely observed in every unit; however, when failure occurred, the concentration of metals was much higher in the kaolin-fed units than in the units not receiving kaolin. Feed concentrations of 220 mg/l Cu, Ni, and Zn and 440 mg/l Cr were reached in one of the kaolin fed units while the highest concentration fed to the units not receiving kaolin reached 180 mg/l Cu, Ni, Zn, and 360 mg/l Cr.

Digester failure was in part due to mechanical problems with the digester temperature control unit.

Application of Research Results

Results from this project are ultimately applicable to control heavy metal inhibition or toxicity in anaerobic sludge digesters.

Publications

No publications have resulted from this research to date. However, publications and/or presentations at scientific meetings are anticipated.

Project Status

The present project will continue in progress over the next fiscal year.

Work Remaining and Progress Contemplated During Next Fiscal Year

The digesters have been reacclimated and work is continuing in order to ascertain the maximum concentrations of heavy metals which can be accommodated without causing digester failure.

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-095-GA

AGREEMENT NO. 14-34-0001-1111

FCCSET RESEARCH CATEGORY: 5D

PROJECT TITLE:

Kinetic Model for Ozonation of Toxic Water Contaminants

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN -- MONTH: 10 ; YEAR: 1980

TO BE COMPLETED -- MONTH: 3 ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
F. Michael Saunders	Ph.D.	Environmental Engineering
Joseph P. Gould	Ph.D.	Environmental Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Edward P. Minchew	MSSE	Environmental Engineering

(A) Research Project Accomplishments. Research during the past fiscal year has continued to be directed towards refinement of analytical procedures for the determination of ozone, phenolic compounds and degradation products of ozone and phenolic compounds. A number of procedures have been investigated for applicability to specific experiments, reproducibility of results and linearity of calibrations.

The kinetics of ozone decomposition at pH levels from 3 to 10 in buffer solutions have been established. The decomposition has been shown to follow variable-order kinetics, varying from one-half to second order. These results are to be included with those for overall decomposition of target solutes in model development.

A procedure reported by Horgne' and Bader (1981) for the determination of aqueous ozone through bleaching of the blue dye, indigo trisulfonate, has been adapted to the present research. In the development of this process, it was determined that measurement of ozone by the standard iodometric technique is unreliable, and is highly dependent upon the speed with which the titration is performed. Furthermore, monitoring ozone degradation via absorbance of ultraviolet radiation over a period of several minutes was found to be unacceptable. Absorbance of ultraviolet radiation resulted in an accelerated rate of degradation of aqueous ozone when compared to a similar solution not exposed to the radiation.

Chromatographic procedures for the analysis of phenolic compounds have been analyzed with a high degree of reproducibility and linearity. In addition, it was discovered that three initial decomposition products, i.e., catechol, hydroquinone and resorcinol, could be detected quantitatively by gas chromatography. Use of gas chromatography - mass spectroscopy allows for specific identification of these compounds and methods for isolation and identification of these compounds from aqueous solution have been established.

Research currently being conducted is focused on examination of the kinetics of solute decomposition. Two reactor systems are being used. One reactor includes direct ozone addition in the gaseous form through a diffuser system and ozone bubbles are maintained in the continuous-flow reactor. A second reactor does not contain ozone bubbles since ozone is supplied to the reactor in the dissolved form. The principal objective of these experiments is to determine the impact of solute competition at the gas-liquid interface (i.e., bubble surface) on solute decomposition using ozone.

(B) Application of Research Results. This project was initiated as a result of a research project conducted for the Georgia Department of Natural Resources - Environmental Protection Division. The earlier project was in response to a need identified by the state agency and was focused on the enhancement of dye biodegradability using preozonation. The research being performed on this project would therefore be supportive of the treatment interests of the carpet and textile industry of the region as well as all industries discharging potentially toxic materials to the environment.

(C) Publications. The following publications have been developed in conjunction with project research:

1. Ozone Enhancement of Dye Biodegradability, Saunders, F. M., Southerland, C. R., and Sorrell, J. F., Final Project Report to GA Environmental Protection Division - EPA Contract #76335, Report No. SCEGIT 79-183, School of Civil Engineering, Georgia Institute of Technology, Atlanta, GA, December 1980

2. "The Effect of Solute Competition on Ozonolysis of Industrial Dyes", Saunders, F. M., Gould, J. P., and Southerland, C. R., Accepted for publication in Water Research, September 1982.

(D) Project Status. The project is a two-year project which is scheduled to be completed in March 1983.

(E) Work Remaining and Progress Contemplated During Next Year. Reaction kinetics and product formation resulting from reaction of dissolved ozone and single solutes are being evaluated and compared with other results published in the literature. These studies are being implemented using a CMF reactor with provision for withdrawal of small amounts for monitoring dissolved ozone levels in the reactor. The effect of surface activity is being studied using multi-component systems and gaseous ozone. Analysis of reaction rate kinetics and products formed will be compared with results obtained from the single-solute, dissolved ozone reactions.

Based on the results obtained from the two studies, a comprehensive model will be developed to describe the ozonation process, including gas-transfer and surface competition effects.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-097-GA

AGREEMENT NO. 14-34-0001- 2111

FCCSET RESEARCH CATEGORY: II B

PROJECT TITLE:

Comparative Study of the Causes and Effects of Recent Southeastern Droughts

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology, Atlanta, Georgia 30332

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: MARCH ; YEAR: 1982	MONTH: MARCH ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
C.G. Justus	Ph.D.	Atmospheric Sciences

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Mark V. Paris	B.A.	Atmospheric Sciences

Research Project Accomplishments. Precipitation data for the State of Georgia and its 9 climatic regions and the State of Texas and 8 of its coastal climatic regions have been assembled and analyzed for periods including the 1954-55 and 1980-81 drought years and intervening periods. Synoptic weather maps for summer periods have been analyzed to determine the relationship between summertime precipitation along the gulf coastal area and existence and placement of the normal Bermuda high pressure system and its excursions into the Gulf of Mexico area. Data for stream flow and lake levels in Georgia have been collected and analyzed in relation to corresponding rainfall deficits in the 1954-55 and 1980-81 drought periods. Tentative conclusions at this stage are: (1) The 1954-55 drought in Georgia was more widespread and more severe than the drought of 1980-81 with generally less precipitation (both regionally and statewide) and generally lower stream flow and lake levels. (2) Georgia statewide average stream flow versus statewide mean annual precipitation (used as a measure of effect-response severity) indicates a linear relationship for the years 1955, and 1979-81. Based on this apparent relationship, the 1980-81 drought period in Georgia was not disproportionately severe in its effects for the amount of precipitation deficit involved. (3) The presence of a Gulf high (as opposed to the normal Bermuda high placement) is associated with lower-than-normal precipitation, but the absence of a Gulf high is not necessarily related to the absence of a drought situation.

Application of Research Results. When completed the research report should be valuable to State of Georgia and Southeast Regional water resources planners, because of its information relating synoptic meteorological situations or summertime droughts.

Publications. A final technical report is in preparation and will be submitted when completed.

Work Remaining. The only remaining work is completion of the final technical report.

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-100-GA

AGREEMENT NO. 14-34-0001-2111

FCCSET RESEARCH CATEGORY: IX

PROJECT TITLE:

Production of a Film on Georgia's Water Resources

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia
Athens, GA 30602

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: March ; YEAR: 1982	MONTH: February ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
James E. Kundell	Ph.D.	Environmental Science
James E. Jackson	Ph.D.	Agronomy

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
None		

(A) Research Project Accomplishments. Work on this film began in March, 1982. Accomplishments thus far include:

1. script development,
2. script narration,
3. production of animation artwork,
4. filming of 75% of the footage, and
5. partial filming of animation.

(B) Application of Research Results. Interest in the film has been voiced by several groups such as: The Georgia Conservancy, Northeast Georgia Area Planning and Development Commission, and units of the University of Georgia. This film will receive widespread use in Georgia. Besides the above mentioned agencies and organizations, it will be used by: school groups, civic organizations, interest groups, and ETV.

(C) Publications. No publications will accompany or result from this film. However, in articles and papers reporting the Georgia Water Resources Technology Transfer Program, the film will be discussed.

(D) Project Status. The project is nearing completion but will require a continuation into the 1983 fiscal year.

(E) Work Remaining and Progress Contemplated During the Next Year. The project will be completed during the first three months of the 1983 fiscal year. This will include the filming of remaining sequences, filming of remaining animated segments and final editing.

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-101-GA

AGREEMENT NO. 14-34-0001- 2111

FCCSET RESEARCH CATEGORY: VI-E

PROJECT TITLE:

Water Resources and Wetlands: A Survey of the Law in Georgia

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia, Institute of Natural Resources

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: March ; YEAR: 1982	MONTH: December ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
J. Owens Smith	J.D.	Natural Resources Law

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Jennifer Hackemeyer	--	Law Student

(A) Research Project Accomplishments.

All statutes, except the Marshland Protection Act, relating to water resources have been described in general paraphrase form. Extensive regulations have received the same treatment.

Each statute has been carefully indexed through the Shepards Citator series to establish all official uses and references, and all case reports have been "briefed" for incorporation into the statutory summaries.

In complying with recent federal statute requirements, Georgia agencies have incorporated by reference many federal regulatory provisions. Many of these regulations have been included in the Georgia materials.

(B) Application of Research Results.

Because the project is not yet complete, its results have not yet been distributed. When complete, the report will be of value to the professionals in the scientific, political and legal communities. The Survey will be a convenient reference tool for persons concerned with all aspects of water resources.

(C) Publications.

No publications have resulted from the project.

(D) Project Status.

The project will be complete by December 30, 1982.

(E) Work Remaining and Progress Contemplated During Next Year.

The Marshland Protection Act, regulations and related cases will be treated as have been other statutes and case law histories will be incorporated.

On November 1, 1982, recodification of the Georgia Code annotated will become effective. All citations to statutes will have to be reviewed and re-numbered where numerical designations have changed.

The Shore Assistance Act has been outlined and will be expanded into the same paraphrase form as the other material.

All sections of the report, with the exceptions noted, are in a first to third draft form. The final coordination or correlation of all sections and preparation of an index should be complete by December 30, 1982.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-102-GA

AGREEMENT NO. 14-34-0001- 2111

FCCSET RESEARCH CATEGORY: 03F

PROJECT TITLE:
Irrigation System Efficiency Survey For Georgia

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia
Agricultural Engineering Department
Coastal Plain Experiment Station
Tifton, Georgia

PROJECT BEGAN --
MONTH: March ; YEAR: 1982

TO BE COMPLETED --
MONTH: September; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
J. R. Stansell	Ph. D.	Agricultural Engineering
Kerry A. Harrison	M.S.	Agricultural Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Chris Butts	M.S.	Agricultural Engineering
Joe Garner	B.S.	Agricultural Engineering

A. Project Accomplishments

Fifteen (15) pumping plants were tested. Six (6) of these were diesel operated and nine (9) were electrical operated systems. The average performance rating was 80.5% and 85.7% for diesel operated and electrical operated systems respectively.

Coefficient of uniformity tests were performed for seven systems. The average coefficient of uniformity as calculated by the Christiansen and Heerman-Hein methods were 83.7 and 80.7 percent, respectively.

Water application amounts for all seven systems was in close agreement with amounts expected by the farmer.

B. Applications

One field day was held in Screven County in which 150 people attended. The objective of the field day was to show irrigators how to perform the test themselves.

C. Publications: none

D. Project Status: A completion report has been submitted to USDI.

E. Work Remaining: none

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. A-103-GA

AGREEMENT NO. 14-34-0001-2111

FCCSET RESEARCH CATEGORY: II-D

PROJECT TITLE:

Basin Scale Evapotranspiration Determination Through Watershed and Climate Analysis

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia - Southern Piedmont Conservation Research Center
Watkinsville, GA 30677

PROJECT BEGAN -- MONTH: October ; YEAR: 81

TO BE COMPLETED -- MONTH: March ; YEAR: 83

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Lowry A. Harper	Ph.D.	Soil Science - Meteorology
Willard B. Snyder	M.S.	Hydrology
Donald W. Kolberg	Ph.D.	Geography

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
James Wilson III	(none)	Agricultural Engineering

A. Research Project Accomplishments.

Water balance equations have been formulated to include a direct expression for evapotranspiration at basin scale. Algorithms and a computer program have been developed in order to quantify the evapotranspiration expression from historical data. Four data sets were obtained and currently these are being used with an optimizing routine to test the basin-scale evapotranspiration model.

Additionally, a water-yield model was optimized for the four drainage basins. The comparison provided allows for further judgements of the adequacy of the new model.

B. Application of Research Results.

The results of this research is applicable to basin-scale water resources planning and utilization. The results can be used to determine water gain and loss due to vegetation cover changes, agricultural practices, and climatic changes.

C. Publications.

None

D. Project Status.

This project was scheduled to begin October 1, 1981 but was delayed to September 1982. Final completion date is March 1983. The project is on schedule.

E. Work Remaining and Progress Contemplated During Next Year.

The project has progressed through most of the data analysis phase and only additional computer runs are required. Final overall analysis and interpretation of model results remain.

PART III

MATCHING GRANTS

WATER RESOURCES RESEARCH PROGRAM UNDER PUBLIC LAW 95-467

BUREAU OF RECLAMATION--U.S. DEPARTMENT OF THE INTERIOR

PROJECT NUMBER	PROJECT TITLE	PRINCIPAL INVESTIGATOR
	Projects Active During FY 1982	
B-127-GA	"Valuation and Acquisition of Floodplain Lands for Stream Valley Parks"	C.F. Floyd, Department of Real Estate, University of Georgia
B-141-GA	"Organic Solvent Regeneration of Activated Carbon in Textile Waste Treatment	J.P. Gould, School of Civil Engineering, Georgia Tech
B-142-GA	"Effects of Alternative Cost Sharing Arrangements on State Water Resources Investments"	K.J. Hatcher and R.M. North, Institute of Natural Resources, University of Georgia
B-147-GA	"Quantitative Models for the Minimization of Uncertainty and Nonquantitative Variables in Pollution Control Planning"	A.O. Esogbue, School of Industrial and Systems Engineering, Georgia Tech
B-155-GA	"The Effect of Hydroperiod on Floodplain Forest Production"	J.B. Birch, J.L. Cooley and E.P. Odum, Institute of Ecology, University of Georgia

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ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. B-127-GA

AGREEMENT NO. 14-34-0001- 7100

FCCSET RESEARCH CATEGORY: 6F

PROJECT TITLE:
VALUATION OF FLOODPLAIN LANDS FOR STREAM VALLEY PARKS

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Department of Real Estate and Legal Studies
The University of Georgia
Athens, Ga.

PROJECT BEGAN -- MONTH: October ; YEAR: 1976

TO BE COMPLETED -- MONTH: June ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Charles F. Floyd	Ph.D.	Economics

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND

A. Research Project Accomplishments

The project has provided a guide to appraisers and others interested in the valuation of floodplain lands for stream valley parks. This is a problem rarely encountered by appraisers and these guidelines were definitely needed.

B. Application of Research Results

It is anticipated that the results will be used by practicing appraisers as well as by public officials who may be acquiring floodplain lands for stream valley parks.

C. Publications

An article based on this report has been submitted to the Appraisal Journal.

D. Project Status

The project has been completed.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. B-141-GA

AGREEMENT NO. 14-34-0001-9064

FCCSET RESEARCH CATEGORY: 3-C, E, 5-D

PROJECT TITLE:

Organic Solvent Regeneration of Activated Carbon in Textile Waste Treatment

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN --

MONTH: November ; YEAR: 1978

TO BE COMPLETED --

MONTH: September ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Dr. Wendall H. Cross	Ph.D.	Analytical Chemist
Dr. Makram T. Suidan	Ph.D.	Environmental Engineer
Dr. Joseph P. Gould	Ph.D.	Environmental Chemist

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Michael A. Rollor	Ph.D.	Environmental Engineer
Stepehn A. Vargo	M.S.	Civil Engineer
Charles M. Paulk	M.S.	Civil Engineer

Research Project Accomplishments

Four adsorbates of varying molecular weights and sizes were employed along with five commercially available activated carbons in a series of continuous flow column studies in order to evaluate the effects of molecular size, regeneration temperature, solvent type and activated carbon characteristics on regeneration efficiency. In addition, the reuse of non-recovered (contaminated) solvent and the corresponding effect upon the economic feasibility of the regeneration process were examined.

From these investigations, it was concluded that the important aspects of the solvent regeneration process include:

a) the physical and chemical characteristics of the adsorbent, particularly the pore size distribution and energy of adsorption associated with the activated carbon,

b) the degree of solubility of the adsorbate in the organic solvent,

c) the miscibility of the organic solvent in water, and

d) the temperature at which the regeneration is performed.

Economic feasibility of the process was determined to be directly related to costs incurred for energy requirements and to the recoverability of valuable adsorbates for subsequent reuse in the industrial process.

Application of Research Results

Data generated by the project is applicable to estimating the cost of installing and operating a solvent regeneration system for those adsorbate-adsorbent systems studied. In addition the overall experimental procedure can be used as a guide in obtaining similar data for other adsorbate-adsorbent systems.

The above information would be of value to personnel evaluating the carbon adsorption-regeneration process as a means of wastewater treatment.

Publications

"Effect of Granular Activated Carbon Structure on Solvent Regeneration", Rollar, M. A., Suidan, M. T., and Cross, W. H., Accepted for publication AIChE Journal.

Other papers are presently being prepared for submission for publication.

Project Status

This project was completed and the final technical completion report submitted September 1982.

Work Remaining and Progress Contemplated During Next Year

None

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. B-142-GA

AGREEMENT NO. 14-34-0001-9065

FCCSET RESEARCH CATEGORY: 6C

PROJECT TITLE:

Effects of Alternative Cost Sharing Arrangements on State Water Resources Investments.

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia, Athens, GA 30602

PROJECT BEGAN -- MONTH: October ; YEAR: 1978

TO BE COMPLETED -- MONTH: December ; YEAR: 1981

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Ronald M. North	PhD	Agricultural Economi
Kathryn J. Hatcher	MS	Civil Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Phillip Glover	BA	Economics
Teresita Madrid	BA	Economics

(A) Research Project Accomplishments. Historical aspects of Federal/non-federal sharing of water resources costs were reviewed for projects and programs. The theoretical basis for these sharing arrangements were explored and the authors suggest that the only theoretically sustainable purpose for cost sharing is that of effecting changes in economic distribution or equity -- not efficiency. The alternative cost sharing policies proposed in 1975, 1976, 1977, and 1978 were described and evaluated with respect to anticipated changes in shares of cost burdens should certain options be adopted. These evaluations were done in detail for flood damage reduction in the south Atlantic Gulf region. General estimates of cost sharing in Georgia were developed from available State budget data. All cost sharing and financing proposals emanating from Federal and state sources, in common, support or accede to a decreasing Federal financial and cost burden offset by increasing state assumption of both financing and cost burdens -- some of which would be recovered from beneficiaries through user charges.

(B) Application of Research Results. Completion Report ERC 0782.

(C) Publications. Completion Report ERC 0782.

(D) Project Status. Project is completed.

(E) Work Remaining and Progress Contemplated During Next Year. Completed.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. B-147 - GA

AGREEMENT NO. 14-34-0001-0215

FOCSET RESEARCH CATEGORY: 6A

PROJECT TITLE:
"Quantitative Models for the Minimization of Uncertainty and Nonquantitative Variables in Non-Point Source Water Pollution Control Planning"

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, GA 30332

PROJECT BEGAN -- MONTH: October ; YEAR: 1979

TO BE COMPLETED -- MONTH: December ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Augustine O. Esogbue	Ph.D.	Systems Engineering and Operations Research
Daryl Chubin (up to 1981)	Ph.D.	Sociology

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
1. Zikehi Ahipo (up to 1981)	M.S.	Operations Research
2. Kok-Weay Looi (up to 1981)	B.S.	Mathematics
3. Tim Jester (up to 1980)	M.S.	Management Science
4. Chaeyoung Lee	M.S.	Operations Research
5. Robert Seydel	Ph.D.	Physics

Research Project Accomplishments

This research had four objectives. The *first* dealt with developing a method for identifying, quantifying, and minimizing fuzziness prominent in State Nonpoint Source Water Pollution Control Laws. Sources of this fuzziness were identified. A questionnaire was designed to deal with the fuzzy variables. The *second* aspect proposed a scientific determination of a nearly exhaustive set of best management practices (BMP's). This set was determined. The *third* referred to the development of a model to evaluate the effectiveness of BMP's as a means of controlling nonpoint source pollution problems. Basic understanding of these BMP's and how they operate were attained through studies of the literature and analysis of several sets of questionnaires administered to planners, developers and the public. One set was restricted to Georgia while another was sent to directors of on going experimental BMP evaluation studies sponsored by USGS in various counties in the U.S. The structural BMP's questionnaire for the State of Georgia was analyzed using our hierarchical model and three fuzzy clustering algorithms: heuristic, dynamic programming and that of Bezdek's. A comparative analysis of these algorithms in the context of our problem was made and reported as an invited paper at the Third International Conference on Mathematical Modelling. The questionnaire to planners and participants was analyzed, again using our hierarchical effectiveness evaluation model. Effectiveness factors were obtained. A statistical analysis of these factors was performed leading to certain conclusions.

Publications

1. Esogbue, A.O., "A Fuzzy Sets Approach to Public Participation

Effectiveness Measurement in Water Quality Planning," Applied Systems and Cybernetics, Vol. VI, pp. 3076-3081, G. Lasker, (editor), Pergamon Press, 1981

2. Esogbue, A.O. and Z. Ahipo, "Fuzzy Sets and Water Resources Planning", in: Fuzzy Sets and Possibility Theory, R. Yager (editor), Pergamon Press 1981

3. Esogbue, A.O. and Z. Ahipo, "A Fuzzy Sets Model for Measuring the Effectiveness of Public Participation In Water Resources Planning", Water Resources Bulletin, Vol.18, No. 3, 1982

4. Esogbue, A.O., "A Fuzzy Sets Model for the Evaluation of Best Management Practices in Nonpoint Source Water Pollution Policy Formulation" in: Approximate Reasoning in Decision Analysis, M.M. Gupta and E. Sanchez (editors), North Holland, Fall 1982

5. Esogbue, A.O. and R.E. Bellman, "Fuzzy Dynamic Programming and Its Extension", Fuzzy Sets and Decision Analysis, TIMS Studies in Management Science, Special Issue, Gaines Zimmermann and Zadeh (editors)

6. Esogbue, A.O., "Contributions to Fuzzy Dynamic Programming" Second World Conference on Mathematics at the Service of Man, Las Palmas, Spain, June 1982

7. Esogbue, A.O., "Evaluation of Productivity of Advisory Groups in Water Resources Planning", ORSA/TIMS National Meeting, Detroit, Michigan, April 1982

Project Status

The formal life of this project (including a granted no-cost time extension has expired. Currently, a final report is being prepared.

Publication of Research Results

As was noted earlier, several papers have already been written on the results emanating from this project. Several invited presentations were made at various professional meetings, some dealing exclusively with this project while others refer to or use aspects of the project to validate some models.

Work Remaining and Progress Contemplated During Next Year

Final report preparation is in progress. It is expected to be completed in December 1982.

Form OWI-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. B-155-GA

AGREEMENT NO. 14-34-0001- 1216

FCCSET RESEARCH CATEGORY: 6G

PROJECT TITLE:

The Effect of Hydroperiod on Floodplain Forest Production

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

University of Georgia, Athens, Georgia 30602

PROJECT BEGAN -- MONTH: 11 ; YEAR: 1980

TO BE COMPLETED -- MONTH: 3 ; YEAR: 1983

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Joe B. Birch	PhD	Biology
James L. Cooley	PhD	Zoology
Eugene P. Odum	PhD	Biology

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Charles Edwards		Forestry
Bryan Doran		Forestry
Dorthy Findlay	BS	Science Education

A. Research Project Accomplishments

Floodplain forest study sites were established along the Savannah River between Augusta and Savannah. These sites were selected to represent the range of elevations present in the floodplains. Daily river discharge rates were converted to gauge heights for the years between 1940 and 1980 and the gauge height of each study site was then estimated for the 40 year period. The widths of tree rings developed during that 40 years were measured as well as other measurements that allow for estimating tree production of the various tree species in each of the study sites for each of the years.

B. Application of Research Results

We have been involved with several organizations that have expressed an interest in the results of this research program. These include Groton Plantation which is the largest plantation in South Carolina and has extensive floodplain forests. They are very interested in maximizing hardwood production on these lands and have been very helpful with the program. Much of the work has been done in their forests. The National Audubon Society is interested in learning how ecosystems on their reserves function so that they may manage them more efficiently. They have provided this program with additional Savannah River floodplain forest study sites on their Silver Bluff Plantation as well as providing other assistance and quarters. Union Camp Corporation owns extensive floodplain hardwood forests in North Carolina, South Carolina, and Georgia and are interested in applying the best management techniques for timber production. They have expressed an interest in this program and have assisted us in locating appropriate study sites.

C. Publications

There have been no publications to date.

D. Project Status

The field and laboratory work is complete. The analytical work is continuing and the project is scheduled for completion in March 1983.

E. Work Remaining and Progress Contemplated During Next Year

Complete the analysis of the relationship between flood patterns and tree growth.

PART IV

FOCUSED RESEARCH PROJECTS

WATER RESOURCES RESEARCH PROGRAM UNDER PUBLIC LAW 95-467

BUREAU OF RECLAMATION--U.S. DEPARTMENT OF THE INTERIOR

PROJECT NUMBER	PROJECT TITLE	PRINCIPAL INVESTIGATOR
	Projects Active During FY 1982	
C 00161-C	"Water Conservation Research Priorities for Water Resources Management Agencies of the South-Atlantic Gulf States"	D.W. Kolberg, Environmental Resources Center, Georgia Tech
C 10041-R	"Reuse and Recycling in the Pulp and Paper Industry"	J.C. Wyvill, Engineering Experiment Station, Georgia Tech

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. C 00161-C

AGREEMENT NO. 14-34-0001- 0506

FCCSET RESEARCH CATEGORY: III D-E-F

PROJECT TITLE:

Water Conservation Research Priorities for Water Resources Management Agencies of the South Atlantic Gulf States

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN --	TO BE COMPLETED --
MONTH: September ; YEAR: 1980	MONTH: October ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
Donald W. Kolberg	Ph.D.	Geography

(Eight additional principal investigators in eight southeastern states)

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND

A. Research Project Accomplishments.

The overall objective of this project was to implement a regional program of water conservation research conducted by specialists from participating southeastern states. Individual project managers in association with state water management agencies, focused their research activity on priority problems in three principal water use categories; agriculture-irrigation, industrial, and domestic and commercial. The project will be concluded with four publications directed to water conservation principles in the above categories.

Individual research accomplishments by category include:

Agriculture-Irrigation:

The objective of this project is to optimize two crop seasons (soy bean production) through irrigation management. This research resulted in the development of a numerical simulation model which allows for the optimization of irrigation scheduling and the value of irrigation water to be calculated in terms of expected yield increase.

Industrial Water Conservation:

Project 1 - Water Use and Conservation in Major Industrial Groups of North Carolina

The objective of this project was to determine and clarify attitudes and incentives that effect water conservation; identify exemplary practices, generate industry-based estimates of the impacts of water shortage with respect to employment and production losses; and develop data helpful in state program development of water conservation programs appropriate to industry groups. Research findings were based upon data obtained by a structured interview procedure with 114 industrial plant managers.

Project 2 - Water Conservation and Cost in Manufacturing in the Pascagoula River Basin

The objective of this study is to develop a data base on present and anticipated water use in the manufacturing industry in the Pascagoula River Basin. The completed analysis includes industrial water use in relation to source, primary categories of use, and information on costs and conservation techniques.

Domestic-Commercial:

Five state projects which focus on local, substate and state water conservation issues have been completed. The final project reports will be combined into a single publication emphasizing regional applications of the research results.

B. Application of Research Results.

The results of this research has direct application to water use problems throughout the southeast. All participating state water management agencies will receive final publications for review and possible application.

C. Publications.

The eight individual state research projects will be published in four volumes. Individual reports are:

1. "Water Conservation Technology in Textiles-state of the Art"
2. "Irrigation Management for the Conservation of Limited Water Resources"
3. "Water Conservation and Cost Restrictions in Manufacturing in the Poscagoula River Basin"

The fourth publication, containing the reports from Virginia, Georgia, Tennessee, South Carolina, and North Carolina, focuses on domestic/commercial water conservation in a regional framework.

D. Project Status.

The project is nearly completed. All individual final project reports have been completed. The final regional project report will be completed within a month.

E. Work Remaining and Progress Contemplated Next Year.

The project will be concluded within a month with the submission of the final regional report.

Form OW-1
(Rev. 10/80)

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. C10041-R

AGREEMENT NO. 14-34-0001- 1468

FCCSET RESEARCH CATEGORY: III-C

PROJECT TITLE:

An Evaluation of the Potential for Water Reuse in the Pulp and Paper Industry

NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

PROJECT BEGAN -- MONTH: September ; YEAR: 1981

TO BE COMPLETED -- MONTH: November ; YEAR: 1982

PRINCIPAL INVESTIGATORS	DEGREE	DISCIPLINE
J. Craig Wyvill	B.S. M.B.A.	Mechanical Engineering Business Administration
John C. Adams	M.S.	Engineering Science & Mechanics
Greer E. Valentine	M.S.	Environmental Engineeri
Jude T. Sommerfeld	Ph.D.	Chemical Engineering

STUDENT ASSISTANTS[1/]	DEGREE HELD (IF ANY)	DISCIPLINE OR ACADEMIC BACKGROUND
Thomas C. Shellnut Graduate Research Assistant	B.S.	Chemical Engineering

A3034

(A) Research Project Accomplishments

This research project was undertaken to assess both the current level of water reuse/recycle and the potential for increasing reuse/recycle in the pulp and paper industry. The focus of the research has been on characterizing water usage patterns and reuse/recycle opportunities using a systems engineering approach. This involved subdividing major processes into functional subsystems and determining the water demands of each system. The individual process water savings possible by substitution of alternative subsystems or the addition of water treatment and recycle systems are then determined and through extrapolation, the magnitude of national water savings possible for each process improvement estimated. Barriers to water reuse and areas for additional research to encourage water reuse are also being identified.

As a means of gathering data first hand on current practices in the industry, approximately 25 mills are being visited to collect data on water consumption, amount and type of water reuse/recycle, and the identification of conditions preventing further reuse/recycle. The study is expected to provide significant insight into current water use and help identify steps that can be taken to increase water reuse/recycle throughout the pulp and paper industry.

(B) Application of Research Results

The results of this study will be useful throughout the pulp and paper industry. Industry and government planners are expected to utilize this information in evaluating actions to promote growth in the industry, and educational and trade institutions are expected to use this information in fostering effective water usage.

(C) Publications - Quarterly Reports

Title: An Assessment of the Potential for Water Reuse in the Pulp and Paper Industry.

Authors: John C. Adams
Thomas C. Shellnut
Greer E. Valentine
J. Craig Wyvill

Dates of Issue: December 1981
March 1982
June 1982

(D) Project Status

Technical project complete. Draft final report in preparation.

(E) Work Remaining and Progress Contemplated During Next Year

Issuance of Final Report.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF INTERDISCIPLINARY PROGRAMS
205 OLD CIVIL ENGINEERING BUILDING
ATLANTA, GEORGIA 30332

ENVIRONMENTAL RESOURCES CENTER
(404) 894-2375

BIOENGINEERING CENTER
(404) 894-2375

January 17, 1983

Mr. F. William Koop
Bureau of Reclamation
Attention: Code 1750
18th and "C" Streets, NW
Washington, DC 20240

Dear Mr. Koop:

Six copies of the Fiscal Annual Report for 1982 of the Matching Fund Program in Georgia are enclosed. I am also enclosing for your information a copy of our Annual Report for 1982 that we submitted to the Office of Water Policy.

We would be glad to provide any further information that you need.

Sincerely yours,

Bernd Kahn

BK:c
Enclosures

xc: Director, OCA

December 1982

ANNUAL FISCAL REPORT

MATCHING FUND PROGRAM IN GEORGIA

UNDER PUBLIC LAW 95-467

FISCAL YEAR 1982

Environmental Resources Center
Georgia Institute of Technology
Atlanta, Georgia 30332

Form OW-5
(Rev. 10/80)

FY 1982 ANNUAL REPORT

SUMMARY SHEET

ANNUAL COOPERATIVE PROGRAM [ ] or MATCHING FUND PROGRAM [x]

(Prepare a Separate Summary Report for each Program and Indicate By ✓ Above)

State Where Institute is Located: Georgia

Total Number of Projects Underway, FY 1982: 5

Of these, number completed during FY: 3

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No.: 5 Work-Months: 12.62	( )	(35,175.07)	(25,037.71)	(60,212.78
Other Professional Staff No.: 4 Work-Months: 11.67	( )	(1,804.93)	(21,501.00)	(23,305.93
Grad. Stu. Assts. & Tech. No.: 4 Work-Months: 2.8	( )	(1,749.99)	((217.32))	(1,532.67
Undergrad. Stu. Assts. & Tech. No.: Work-Months:	( )	( )	( )	(
Non-Stu. Techs. & Others No.: Work-Months:	( )	( )	( )	(
Total:	154,948.81	38,729.99	46,321.39	85,051.38
B. Employee Benefits Total:	19,853.57	5,517.60	10,905.65	16,423.25
C. Non-Expendable Property Total:	8,201.00		(1,200.00)	(1,200.00)
D. Expendable Property Total:	10,680.91	2,065.55	(1,999.51)	66.04
E. Other Cost (specify) Consultants	(4,500.00)			
Travel/Per Diem	4,701.35)	(3,161.29)	((200.00))	(2,961.29
Delphi Session/Boat Maintenance	(1,460.00)			
Overhead	(107,015.77)	(24,182.44)	(31,915.92)	(56,098.36
Surveys/Computer	(3,785.47)	(854.65)		(854.65
Project Report/Publication	(4,058.87)	(1,106.87)	( )	(1,106.87
Total:	125,521.46	29,305.25	31,715.92	61,021.17
Total Expenditures FY 1982:	319,205.75	75,618.39	85,743.45	161,361.84

This summary report includes, but is not limited to, the following projects completed during the reported fiscal year (show OWRT project numbers):

B-141-GA
B-146-GA
B-142-GA

1/ Total Federal and Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2/ Actual expenditures, including firm outstanding commitments (or obligations); for example, unliquidated orders for equipment.

ACP and HEP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

State where Institute is located: Georgia

Report as of September 30, 1982

OWRT Project No: B-141-GA
Agreement No: 14-34-0001-9064
Federal Amount of Agreement: $2,189.00
Type of Project: Annual Cooperative [ ]
Matching Fund [X]
Tech. Transfer [ ]

Project Title: Organic Solvent Regeneration of Activated Carbon in Textile Waste Treatment

Principal Investigator(s): J. P. Gould, M. T. Suidan

Project Starting Date November 1, 1978; Actual/Scheduled Completion Date Oct. 31, 19

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	29,000.00			
Other Professional Staff No: 1 Work-Months: 3.9	15,000.00		10,770.96	10,770.96
Grad. Stu. Assts. & Tech. No: 1 Work-Months: -10.2	15,042.00		(6,249.96)	(6,249.96
Undergrad. Stu. Assts. & Tech. No: Work-Months:		-		
Non-Stu. Techs. & Others No: Work-Months:		-		
Total:	59,042.00		4,521.00	4,521.00
Employee Benefits Total:	3,444.00		2,186.75	2,186.75
Non-Expendable Property Total:	8,000.00		(1,200.00)	(1,200.00
Expendable Property Total:	8,020.00	476.99	(1,999.51)	(1,522.52
Other Cost (specify) Travel	1,000.00	- 0 -	(200.00)	(200.00
Per Diem & Fees Publication		643.64		643.64
Overhead	44,872.00	297.30	9,930.75	10,228.05
Total:	45,872.00	940.94	9,730.75	10,671.69
Total Expenditures FY 1982		1,417.93	13,238.99	14,656.92
Cumulative Expenditures since Start of Project (if Multiyear)	124,378.00	62,189.00	64,727.44	126,916.44

1/ Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2/ Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

State where Institute is located: Georgia

Report as of September 30, 1982

OWRT Project No: B-142-GA
Agreement No: 14-34-0001- 9065
Federal Amount of Agreement: $ 35,000.00
Type of Project: Annual Cooperative [ ]
Matching Fund [X]
Tech. Transfer [ ]

Project Title:
Effects of Alternate Cost Sharing Arrangements on the State Water Resources Investments.

Principal Investigator(s):
J. Sellers & R. M. North

Project Starting Date October 1, 1982; Actual/Scheduled Completion Date Sept. 30 19

Cost Categories and Work Months		Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
a. Salaries and Wages					
Principal Investigator(s) No: Work-Months:		(5,207.00)	( )	( )	( )
Other Professional Staff No: Work-Months:		( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:		((6,853.47))	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:		( )	(-)	(.)	( )
Non-Stu. Techs. & Others No: Work-Months:		( )	(-)	( )	( )
	Total:	(1,646.47)			
b. Employee Benefits	Total:	379.00			
c. Non-Expendable Property	Total:				
d. Expendable Property	Total:				
e. Other Cost (specify)	Surveys	(1,980.00)			
	Travel	(1,558.39)			
	Reproductions	(1,958.87)	(463.23)		(463.23)
	Computer	(280.78)			
	Overhead	((369.00))	( )	( )	( )
	Total:	1,730.70	463.23		463.23
Total Expenditures FY 1982			463.23	- 0 -	463.23
Cumulative Expenditures since Start of Project (if Multiyear)		70,000.00	35,000.00	35,000.00	70,000.00

1/ Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2/ Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

te where Institute is located:
Georgia

Report as of September 30, 19 82

T Project No: B-146-GA
eement No: 14-34-0001- 1215
eral Amount of Agreement: $ 36,795.00
e of Project: Annual Cooperative [ ]
Matching Fund [X]
Tech. Transfer [ ]

Project Title:
Prediction of Irrigation Water Demands in the Southeastern United States

ncipal Investigator(s):
Jerry L. Chesness

ject Starting Date November 1, 1980; Actual/Scheduled Completion Date June 30, 19

t Categories and Work Months	Budgeted 1/ Total	Expenditures FY 19 82 2/ Federal	Non-Federal	Total
Salaries and Wages	19,000.00			
Principal Investigator(s) No: 1 Work-Months: 5	( )	9,391.02	13,225.00	22,616.02
Other Professional Staff No: 1 Work-Months: .92	( )	( )	5,486.00	5,486.00
Grad. Stu. Assts. & Tech. No: 1 Work-Months: .10	( )	( )	1,032.66	1,032.66
Undergrad. Stu. Assts. & Tech. No: 0 Work-Months: 0	( )	-	( )	
Non-Stu. Techs. & Others No: 0 Work-Months: 0	( )	-	( )	
Total:	19,000.00	9,391.02	19,743.66	29,134.68
Employee Benefits Total:	4,180.00	1,925.61	4,760.48	6,686.09
Non-Expendable Property Total:				
Expendable Property Total:		540.07		540.07
Other Cost (specify) Computer	750.00	750.00		750.00
Travel	(1,250.00)	(709.64)		(709.64)
Publication	500.00			
Indirect Cost	11,115.00	5,493.75	11,550.04	17,043.79
Total:	13,615.00	6,953.39	11,550.04	18,503.43
al Expenditures FY 19 82		18,810.09	36,054.18	54,864.27
ulative Expenditures since rt of Project (if Multiyear)	73,590.00	35,773.76	36,054.18	71,827.94

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

State where Institute is located: Georgia

Report as of September 30, 1982

OWRT Project No: B-147-GA
Agreement No: 14-34-0001-0215
Federal Amount of Agreement: $ 79,383.35
Type of Project: Annual Cooperative [ ]
Matching Fund [X]
Tech. Transfer [ ]

Project Title: Quantitative Models for the Minimizing of Uncertainty and Nonquantitative Variables in Pollution Control Planning.

Principal Investigator(s): D. Chubin, A. O. Esogbue

Project Starting Date July 1, 1980; Actual/Scheduled Completion Date Dec. 31 · 1

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: 2.32	(10,688.25)	(2,972.32)	(7,988.91)	10,961.2
Other Professional Staff No: 2 Work-Months: 6.85	(4,500.00)	(1,804.93)	(5,244.04)	7,048.9
Grad, Stu. Assts. & Tech. No: 2 Work-Months: 13	(9,410.04)	(1,749.99)	(4,999.98)	6,749.97
Undergrad. Stu. Assts. & Tech. No: Work-Months:	(4,056.00)	(-)	( )	
Non-Stu. Techs. & Others No: Work-Months:	((3,661.66))	( )	( )	
Total:	24,992.63	6,527.24	18,232.93	24,760.17
B. Employee Benefits Total:	(713.05)	(863.30)	1,533.70	670.40
C. Non-Expendable Property Total:				
D. Expendable Property Total:	2,269.83	790.46		790.46
E. Other Cost (specify) Overhead	(20,063.79)	(5,046.53)	(8,198.21)	(13,244.7
Travel	631.14	1,595.24		1,595.2
Consultants	(4,500.00)			
Computer	1,336.25	104.65		104.6
Delphi Session	(1,000.00)			
Publication	1,000.00			
Per Diem	(1,214.76)			
Total:	29,745.94	6,746.42	8,198.21	14,944.6
Total Expenditures FY 1982		13,200.82	27,964.84	41,165.6
Cumulative Expenditures since start of Project (if Multiyear)	158,766.70	79,369.78	66,696.75	146,066.5

1) Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95306 ACP and MFP FY 1982 Annual Report (Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

State where Institute is located: Georgia

Report as of September 30, 1982

WRT Project No: B-155-GA
Agreement No: 14-34-0001-1216
Federal Amount of Agreement: $ 70,800
Type of Project: Annual Cooperative [ ]
Matching Fund [XX]
Tech. Transfer [ ]

Project Title: Floodplain Forest Production and Flood Profile

Principal Investigator(s):

J. B. Birch, J. L. Cooley, E. P. Odum

Project Starting Date October, 1981; Actual/Scheduled Completion Date Sept. 30, 19

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
a. Salaries and Wages				
Principal Investigator(s) No: 3 Work-Months: 5.3	(37,247.31)	(22,811.73)	(3,823.80)	26,635.53
Other Professional Staff No: Work-Months:	( )	( )	( )	
Grad. Stu. Assts. & Tech. No: Work-Months:	(5,313.34)	( )	( )	
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	
Non-Stu. Techs. & Others No: Work-Months:	(11,000.00)	( )	( )	
Total:	53,560.65	22,811.73	3,823.80	26,635.53
b. Employee Benefits Total:	12,563.62	4,455.29	2,424.72	6,880.01
c. Non-Expendable Property Total:	201.00			
d. Expendable Property Total:	391.08	258.03		258.03
e. Other Cost (specify) Travel	(2,163.84)	(856.41)	( )	856.41
Boat Maintenance	(460.00)	( )	( )	
Project Completion Report	(600.00)	( )	( )	
Indirect Cost (58.5% S&W) Total:	(31,333.98) 34,557.82	(13,344.86) 14,201.27	(2,236.92) 2,236.92	(15,581.78 16,438.19
Total Expenditures FY 1982		41,726.32	8,485.44	50,211.76
Cumulative Expenditures since Start of Project (if Multiyear)	142,098.00	72,625.84	19,191.91	91,817.75

1) Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF INTERDISCIPLINARY PROGRAMS
205 OLD CIVIL ENGINEERING BUILDING
ATLANTA, GEORGIA 30332

ENVIRONMENTAL RESOURCES CENTER
(404) 894-2375

BIOENGINEERING CENTER
(404) 894-2375

January 17, 1983

Dr. Thomas G. Bahr, Director
Office of Water Policy, USDI
Washington, DC 20240

Dear Dr. Bahr:

Six copies are enclosed of the technical and fiscal Annual Report for FY1982 concerning the activities of the Environmental Resources Center, the water resources research institute in Georgia. Included are forms OW-2, OW-3, OW-4, OW-5, OW-9 and OW-10 for the Annual Cooperative Program.

We trust that submission of this information fulfills the reporting requirements of USDI, but will be glad to provide any additional information that you need.

Sincerely yours,

Bernd Kahn

BK:c
Enclosures

xc: Director, OCA

December 1982

ANNUAL FISCAL REPORT

ANNUAL COOPERATIVE PROGRAM

UNDER PUBLIC LAW 95-467

FISCAL YEAR 1982

Environmental Resources Center
Georgia Institute of Technology
Atlanta, Georgia 30332

G-33-691 ACP and HFP FY 19 82 Annual Report (Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

ate where Institute is located:
Georgia

Report as of September 30, 19 82

RT Project No: A-074-GA
reement No: 14-34-0001- 9011
deral Amount of Agreement: $ 10,500.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
The Nature and Origin of Organic Radioiodine Species in Aqueous Systems

incipal Investigator(s):
Dr. Charles Liotta

oject Starting Date October 1, 1978; Actual/Scheduled Completion Date Sept. 30, 19

st Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	2,354.00			
Other Professional Staff No: Work-Months:	905.04			
Grad. Stu. Assts. & Tech. No: Work-Months:				
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: Work-Months:				
Total:	3,259.04	- 0 -		- 0 -
Employee Benefits Total:				
Non-Expendable Property Total:				
Expendable Property Total:	(1,609.18)			
Other Cost (specify) Irradiation Charges	56.00			
Publication	300.00			
Total:	356.00	- 0 -		- 0 -
tal Expenditures FY 1982		- 0 -		- 0 -
mulative Expenditures since art of Project (if Multiyear)	10,500.00	7,860.14		7,860.14

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

FINAL

Form OW-2
(Rev. 10/80)

AF-95803

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

ate where Institute is located:
Georgia

Report as of September 30, 1982

RT Project No: A-086 - GA
reement No: 14-34-0001-1111
deral Amount of Agreement: $ 8,580.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:

Ground Water Flow in the Southwest Georgia Aquifier

incipal Investigator(s):

George E. Brook, Robert E. Carver

oject Starting Date October 1, 1980; Actual/Scheduled Completion Date December 19

st Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No:1 Work-Months: .38	4,500.00	778.17		778.17
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: Work-Months:	2,500.00			
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: Work-Months:				
Total:	7,000.00	778.17		778.17
Employee Benefits Total:	877.00			
Non-Expendable Property Total:				
Expendable Property Total:	100.00	(37.56)		(37.56
Other Cost (specify) Travel	500.00			
Publication	700.00			
Indirect	3990.00		443.56	443.56
Total:	5,190.00		443.56	443.56
tal Expenditures FY 1982		740.61	443.56	1,184.17
mulative Expenditures since art of Project (if Multiyear)	13,167.00	8,580.00	4,911.68	13,491.68

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95304

Revised Final
ACP and MFP FY 19 82 Annual Report

Form OWRT-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

te where Institute is located:
Georgia

Report as of September 30, 1982

T Project No: A-087-GA
eement No: 14-34-0001-0111
eral Amount of Agreement: $ 8,738.00
e of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Least Cost Wastewater Management Alternatives for Discharges into Samll Ungaged Streams.

ncipal Investigator(s):
K. H. Hatcher

oject Starting Date October, 19 79; Actual/Scheduled Completion Date April 198

t Categories and Work Months	Budgeted 1/ Total	Expenditures FY 19 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	345.00			
Other Professional Staff No: Work-Months:	1,150.40			
Grad. Stu. Assts. & Tech. No: Work-Months: 1.25		1,819.17		1,819.17
Undergrad. Stu. Assts. & Tech. No: Work-Months:		-		
Non-Stu. Techs. & Others No: Work-Months:	600.00	-		
Total:	2,095.40	1,819.17		1,819.17
Employee Benefits Total:	238.87			
Non-Expendable Property Total:				
Expendable Property Total:	(447.23)	895.94		895.94
Other Cost (specify) Travel	324.34	596.27		596.27
Computer, Publications	1,100.00		157.05	157.05
Overhead	1,193.98		1,036.93	1,036.93
Total:	2,618.32	596.27	1,193.98	1,790.25
tal Expenditures FY 19 82		3,311.38	1,193.98	4,505.36
mulative Expenditures since ert of Project (if Multiyear)	13,130.00	8,738.00	4,392.00	13,130.00

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-20-W04
Q5009-1A5

ACP and MFP FY 1982 Annual Report

Form OWRT-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

ite where Institute is located:
Georgia

Report as of September 30, 1982

RT Project No: A-088-GA
reement No: 14-34-0001-1111
deral Amount of Agreement: $ 10,000.00
pe of Project: Annual Cooperative [x]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Identification Assessment of Effluent Residuals in Treated Leachates from Landfill Disposal Sites

incipal Investigator(s):
Dr. F. G. Pohland, Dr. J. P. Gould, Dr. E. S. K. Chian

oject Starting Date October 1, 1982; Actual/Scheduled Completion Date March 19

st Categories and Work Months	Budgeted 1/ Total	Expenditures FY 19 82 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No:1 Work-Months: .24	(380.85)	(931.25)	( )	931.25
Other Professional Staff No: Work-Months:	( )	( )	( )	
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	
Total:	380.85	931.25		931.25
Employee Benefits Total:	270.00	49.26		49.26
Non-Expendable Property Total:				
Expendable Property Total:	770.76	478.62		478.62
Other Cost (specify) Report Preparation	(150.00)	( )	( )	
Travel	(600.00)	( )	( )	
Overhead	(277.52)	( )	(698.44)	698.44
Total:	1,027.52		698.44	698.44
tal Expenditures FY 1982		1,459.13	698.44	2,157.57
mulative Expenditures since art of Project (if Multivear)	16,292.00	9,557.52	6,443.22	16,000.74

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95309 f

ACP and MFP FY 19[82] Annual Report

Form OR-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

te where Institute is located:
Georgia

Report as of September 30, 19 82

T Project No: A-90 - GA
eement No: 14-34-0001-1111
eral Amount of Agreement: $ 9,551.00
e of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title: "Application of Electronical Detectors for Improved Sensitivity in High Performance Liquid Chromotographic Seperation and Quantitation of Ultrabase Pesticide and Cook Phenolic Residues in Water."

ncipal Investigator(s):

James L. Anderson

)ject Starting Date October 1, 1981; Actual/Scheduled Completion Date 9/30, 198

t Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: .36			1,843.87	1,843.87
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: Work-Months:				
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: Work-Months:				
Total:	(482.02)		1,843.87	1,843.87
Employee Benefits Total:	86.65			
Non-Expendable Property Total:	580.20			
Expendable Property Total:	(136.83)	438.00		438.00
Other Cost (specify) Publications			100.00	100.00
Travel	400.00			
Indirect Cost 58.5% Salaires			3,978.00	3,978.00
Total:	400.00		4,078.00	4,078.00
tal Expenditures FY 1982		438.00	5,921.87	6,359.87
mulative Expenditures since art of Project (if Multivear)	15,851.00	9,551.00	6,300.00	15,851.00

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-20-W01

Form OW-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

ate where Institute is located:
eorgia

Report as of September 30, 1982

RT Project No: A-091-GA
reement No: 14-34-0001-1111
deral Amount of Agreement: $3,210.00
pe of Project: Annual Cooperative [x]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:

Aquifier Parameter Prediction
by Numeric Modeling

incipal Investigator(s):
Dr. Mustafa M. Aral

oject Starting Date April 1, 1980; Actual/Scheduled Completion Date Dec. 31, 1982

st Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	( )	( )	( )	( )
Other Professional Staff No: Work-Months:	( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	( )
Total:				
Employee Benefits Total:	210.00			- 0 -
Non-Expendable Property Total:				
Expendable Property Total:				
Other Cost (specify)	( )	( )	( )	( )
	( )	( )	( )	( )
	( )	( )	( )	( )
Total:	210.00			- 0 -
otal Expenditures FY 1982	- 0 -	- 0 -	- 0 -	- 0 -
umulative Expenditures since tart of Project (if Multiyear)	6,900.00	3,000.00	3,690.00	6,690.00

1 Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-70-E01 f
05076-1A3

Form OWR-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

where Institute is located:
Georgia

Report as of September 30, 1982

Project No: A-091-GA
ement No: 14-34-0001-2111
ral Amount of Agreement: $5,873.00
of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Aquifier Parameter Prediction by Numerical Modeling

cipal Investigator(s):
M. M. Aral

ect Starting Date October, 1981; Actual/Scheduled Completion Date March 31, 1983

Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: 1.34	(5,000.00)	(3,713.00)	(500.00)	4,213.00
Other Professional Staff No: Work-Months:	( )	( )	( )	
Grad. Stu. Assts. & Tech. No: 1 Work-Months: 3	( )	2,160.00	( )	2,160.00
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	
Total:	5,000.00	5,873.00	500.00	6,373.00
Employee Benefits Total:	556.00			
Non-Expendable Property Total:				
Expendable Property Total:				
Other Cost (specify) Publication	(873.00)	( )	( )	
Computer	(500.00)	( )	( )	
Overhead	(3,811.00)	( )	3,008.06	3,008.06
Total:	5,184.00		3,008.06	3,008.06
l Expenditures FY 1982		5,873.00	3,508.06	9,381.06
lative Expenditures since t of Project (if Multiyear)	10,740.00	5,873.00	3,508.06	9,381.06

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-20-W02
Q5009-1A3

ACP and MFP FY 1982 Annual Report

Form OWRT-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

ate where Institute is located:
Georgia

Report as of September 30, 1982

RT Project No: A-092-GA
reement No: 14-34-0001-1111
deral Amount of Agreement: $9,000.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Application of Kaolin for Control of Heavy Metal Toxicity in Anaerobic Sludge Digestion

incipal Investigator(s):
W. H. Cross, M. Suidan

oject Starting Date October 1, 1980; Actual/Scheduled Completion Date Sept. 30, 19

st Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: .36	375.00	1,000.00		1,000.00
Other Professional Staff No: Work-Months:				
Grad, Stu. Assts. & Tech. No: 2 Work-Months: .48	1,218.53	593.53		593.53
Undergrad. Stu. Assts. & Tech. No: Work-Months:		-		
Non-Stu. Techs. & Others No: Work-Months:		-		
Total:	1,593.53	1,593.53		1,593.53
Employee Benefits Total:	29.46	115.90		115.90
Non-Expendable Property Total:				
Expendable Property Total:	424.89	(82.86)	421.31	338.45
Other Cost (specify) Travel		-		
Overhead	1,163.28		1,195.15	1,195.15
Total:	1,163.28	- 0 -	1,195.15	1,195.15
tal Expenditures FY 1982		1,626.57	1,616.46	3,243.03
mulative Expenditures since art of Project (if Multiyear)	15,444.00	9,000.00	6,475.87	15,475.87

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-20-E02
Q5076-1A4f

ACP and MFP FY 19 82 Annual Report

Form OR-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

ite where Institute is located:
Georgia

Report as of September 30, 19 82

RT Project No: A-092-GA
reement No: 14-34-0001- 2111
ieral Amount of Agreement: $ 9,000.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Application of Kaolin for Control of Heavy Met Toxicity in Anaerobic Sludge Digestion.

incipal Investigator(s):
W. H. Cross, M. Suidan

oject Starting Date October 1, 1981; Actual/Scheduled Completion Date March 31, 19

st Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: .38	2,000.00	600.00	500.00	1,100.00
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: 5 Work-Months: 4.1	6,000.00	4,151.00	783.35	4,934.35
Undergrad. Stu. Assts. & Tech. No: Work-Months:		-		
Non-Stu. Techs. & Others No: 3 Work-Months: 1		1,110.35		1,110.35
Total:	8,000.00	5,861.35	1,283.35	7,144.70
Employee Benefits Total:	222.00	341.46	57.95	399.41
Non-Expendable Property Total:				
Expendable Property Total:	1,528.00	436.03	575.24	1,011.27
Other Cost (specify) Publication	500.00	-		
Travel	250.00		300.00	300.00
Indirect	5,775.00.		1,884.20	1,884.20
Total:	6,525.00		2,184.74	2,184.20
otal Expenditures FY 1982		6,638.84	4,100.74	10,739.58
umulative Expenditures since tart of Project (if Multiyear)	16,275	6,638.84	4,100.74	10,739.50

1) Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

E-20-W03
Q5009-1A4

Form OWR-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

ite where Institute is located:
Georgia

Report as of September 30, 1982

RT Project No: A-095-GA
reement No: 14-34-0001-1111
deral Amount of Agreement: $9,500.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Kinetic Model for Ozonation of Toxic Water Contaminents

incipal Investigator(s):
F. M. Saunders, J. P. Gould

oject Starting Date October 1, 1980; Actual/Scheduled Completion Date Oct. 30, 19[illegible]

st Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	(1,771.00)			
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: Work-Months:	900.08			
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: Work-Months:				
Total:	(870.92)			
Employee Benefits Total:	(202.86)			
Non-Expendable Property Total:	2,000.00			
Expendable Property Total:	128.34	155.43		155.43
Other Cost (specify) Overhead	(635.77)			
Total:	(635.77)			
tal Expenditures FY 1982		155.43	- 0 -	155.43
mulative Expenditures since art of Project (if Multiyear)	16,805.00	8,383.12	8,158.52	16,541.64

1/ Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2/ Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

I-20-E03
05076-1A5 f

ACP and MFP FY 19 82 Annual Report

Form OW-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY82

te where Institute is located:
Georgia

Report as of September 30, 19 82

T Project No: A-095-GA
eement No: 14-34-0001- 2111
eral Amount of Agreement: $ 9,500.00
e of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Kinetic Model for Ozonation of Toxic Water Contaminants

ncipal Investigator(s):
F. M. Saunders, J. P. Gould

ject Starting Date October 1, 1981; Actual/Scheduled Completion Date March 31, 19

t Categories and Work Months		Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages					
Principal Investigator(s) No: 1 Work-Months: 1.62		1,000.00	5,357.78	500.00	5,857.78
Other Professional Staff No: Work-Months:					
Grad. Stu. Assts. & Tech. No: 1 Work-Months: 6		8,500.00	1,999.98	1,999.98	3,999.96
Undergrad. Stu. Assts. & Tech. No: Work-Months:					
Non-Stu. Techs. & Others No: Work-Months:					
	Total:	9,500.00	7,357.76	2,499.98	9,857.74
Employee Benefits	Total:	112.00	928.12	91.45	1,019.57
Non-Expendable Property	Total:	600.00			
Expendable Property	Total:	1,044.00	651.00		651.00
Other Cost (specify)	Publication	500.00			
	Travel	300.00	228.28		228.28
	Overhead	6,301.00		5,856.04	5,856.04
	Total:	7,101.00	228.28	5,856.04	6,084.32
l Expenditures FY 19 82			9,165.16	8,447.47	17,612.63
lative Expenditures since t of Project (if Multiyear)		18,357.00	9,165.16	8,447.47	17,612.63

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

G-35-637
Q5076-1A7

ACP and MFP FY 1982 Annual Report

Form OWRT-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

ite where Institute is located:
Georgia

Report as of September 30, 1982

RT Project No: A-097-GA
reement No: 14-34-0001-2111
deral Amount of Agreement: $7,300.00
pe of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Comparative Studies of the Causes and Effects of Recent Southern Drought

incipal Investigator(s):
C. G. Justus

oject Starting Date October 1, 1981; Actual/Scheduled Completion Date March 31, 19

st Categories and Work Months	Budgeted 1/ Total	Expenditures FY 19 82 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: .14	680.00	680.00		680.00
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: 2 Work-Months: 6.99	6,113.00	5,149.98		5,149.98
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: Work-Months:				
Total:	6,793.00	5,829.98		5,829.98
Employee Benefits Total:	207.00	78.18		78.18
Non-Expendable Property Total:				
Expendable Property Total:	300.00	41.34		41.34
Other Cost (specify) Overhead	4,015.00		3,272.23	3,272.23
Total:	4,015.00		3,272.23	3,272.23
otal Expenditures FY 19 82	11,315.00	5,949.50	3,272.23	9,221.73
umulative Expenditures since tart of Project (if Multiyear)	11,315.00	5,949.50	3,272.23	9,221.73

) Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95313

Form OWR-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

te where Institute is located:
Georgia

Report as of September 30, 1982

T Project No: A-100-GA
eement No: 14-34-0001-2111
eral Amount of Agreement: $9,000.00
e of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Production of Film on Georgia's Water Resource

ncipal Investigator(s):

Dr. James E. Kundell, Dr. James E. Jackson

ject Starting Date March 1, , 1982; Actual/Scheduled Completion Date Sept. 30, 198

t Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: .5	2,250.00	2,250.00		2,250.00
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: Work-Months:				
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: 1 Work-Months: 2	2,500.00		2,500.00	2,500.00
Total:	4,750.00	2,250.00	2,500.00	4,750.00
Employee Benefits Total:	518.00	542.58		542.58
Non-Expendable Property Total:	2,000.00			- 0 -
Expendable Property Total:	2,732.00	2,538.89	548.95	3,087.84
Other Cost (specify)				
Travel	2,200.00			- 0 -
Equipment	1,300.00	1,073.68		1,073.68
Total:	3,500.00	1,073.68		1,073.68
tal Expenditures FY 1982	13,500.00	6,405.15	3,048.95	9,454.10
mulative Expenditures since ert of Project (if Multiyear)	13,500.00	6,405.15	3,408.95	9,454.10

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95314

Form OW-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

: where Institute is located:
Georgia

Report as of September 30, 1982

Project No: A-101-GA
ement No: 14-34-0001-2111
ral Amount of Agreement: $7,000.00
of Project: Annual Cooperative [x]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Legal Aspects of Water Resources:
A Survey of the Law in Georgia

cipal Investigator(s):
J. Owens Smith

ect Starting Date March, 1982; Actual/Scheduled Completion Date Sept. 30, 1982

Categories and Work Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: Work-Months:	2,845.00			
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: 1 Work-Months: 1.5	4,600.00	3,435.00		3,435.00
Undergrad. Stu. Assts. & Tech. No: Work-Months:		-		
Non-Stu. Techs. & Others No: Work-Months:	600.00	-		
Total:	8,045.00	3,435.00		3,435.00
Employee Benefits Total:	655.00			
Non-Expendable Property Total:				
Expendable Property Total:	500.00			
Other Cost (specify) Travel	700.00			
Report Preparation	600.00			
Total:	1,300.00			
l Expenditures FY 1982	10,500.00	3,435.00		3,435.00
lative Expenditures since t of Project (if Multiyear)	10,500.00	3,435.00		3.435.00

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

AF-95315

Form OW-2
(Rev. 10/80)

ACP and MFP FY 1982 Annual Report

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY

State where Institute is located: Georgia

Report as of September 30, 1982
FINAL

OWRT Project No: A-102-GA
Agreement No: 14-34-0001- 2111
Federal Amount of Agreement: $ 10,400
Type of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title: "Irrigation System Efficiency Survey of Geor

Principal Investigator(s):
Dr. J. R. Stansell
Dr. Kerry Harrison

Project Starting Date March 1, , 19 81 Actual/Scheduled Completion Date 9/30 , 19

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages				
Principal Investigator(s) No: 2 Work-Months: 1	4,130		4,233.33	4,233.33
Other Professional Staff No: Work-Months:				
Grad. Stu. Assts. & Tech. No: Work-Months:				
Undergrad. Stu. Assts. & Tech. No: Work-Months:				
Non-Stu. Techs. & Others No: 4 Work-Months: 7	5,400	8,316.01		8,316.01
Total:	9,530	8,316.01	4,233.33	12,549.34
Employee Benefits Total:	2,473	1,908.57	994.83	2,903.40
Non-Expendable Property Total:				
Expendable Property Total:				
Other Cost (specify)				
Travel	3,000	175.42		175.42
Publication	597			
Total:	3,597	175.42		175.42
Total Expenditures FY 1982	15,600	10,400.00	5,228.16	15,628.16
Cumulative Expenditures since Start of Project (if Multiyear)	15,600	10,400.00	5,228.16	15,628.16

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

B-10-685
Q5076-1A6

ACP and MFP FY 1982 Annual Report

Form OWRT-2
(Rev. 10/80)

Prepare a separate form for each Sec. 101 and Sec. 105(a) Project in Progress During FY 82

te where Institute is located:
Georgia

Report as of September 30, 1982

T Project No: A-103-GA
eement No: 14-34-0001-2111
eral Amount of Agreement: $11,500.00
e of Project: Annual Cooperative [X]
Matching Fund [ ]
Tech. Transfer [ ]

Project Title:
Basin Scale Evapotranspiration Determination Through Watershed and Climate Analysis

ncipal Investigator(s):
D. Kolberg

oject Starting Date October 1, 1982; Actual/Scheduled Completion Date March 31, 19

st Categories and Work Months		Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
Salaries and Wages					
Principal Investigator(s) No: Work-Months:		( )	( )	( )	( )
Other Professional Staff No: Work-Months:		( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:		( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:		( )	( )	( )	( )
Non-Stu. Techs. & Others No: 1 Work-Months: 3.7		(3,400.00)	(3,178.00)	( )	(3,178.00)
	Total:	3,400.00	3,178.00		3,178.00
Employee Benefits	Total:	360.00	146.01		146.01
Non-Expendable Property	Total:				
Expendable Property	Total:	680.00			
Other Cost (specify)	Travel	(600.00)	(56.00)	( )	(56.00)
	Computer	(3,000.00)	( )	( )	( )
	Consultants	(5,000.00)	(3,892.18)		(3,892.18)
	Overhead	(6,325.00)	( )	(3,999.70)	(3,999.70)
	Total:	14,925.00	3,948.18	3,999.70	7,947.88
tal Expenditures FY 1982		19,365.00	7,272.19	3,999.70	11,271.89
mulative Expenditures since art of Project (if Multiyear)		19,365.00	7,272.19	3,999.70	11,271.89

Total Federal/Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

) Actual Expenditures including outstanding commitments (or obligations); for example, unliquidated orders for equipment.

Form OW-3
(Rev. 10/80)

FINAL B-10-658

FY 1982 ANNUAL REPORT

FOR INSTITUTE DIRECTOR'S OFFICE

State where Institute is located: Georgia

Report as of September 30, 1982

Director's Name: Dr. Bernd Kahn

Annual Coop. Agreement:
No.: 14-34-0001-9011

Cost Categories and Work-Months	Budgeted 1/	Expenditures FY 1982 2/		
	Total	Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: Work-Months:	( )	( )	( )	( )
Other Professional Staff No: Work-Months:	( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	( )
Total:				
B. Employee Benefits Total:	246.68			
C. Non-Expendable Property Total:				
D. Expendable Property Total:				
E. Other Cost (specify)	( )	( )	( )	( )
	( )	( )	( )	( )
	( )	( )	( )	( )
Total:				
Total Expenditures FY 1982	246.68	- 0 -	- 0 -	- 0 -

1) Amount budgeted is as set forth in budget (and revisions) submitted to and accepted by OWRT.

2) Actual expenditures including firm outstanding commitments (or obligations); for example, unliquidated orders for supplies or equipment.

3) If total of actual expenditures vary more than 10% from amount budgeted an explanation of suc variance should be provided on an attachment to this sheet.

3-10-663
Q5007-0A0

Form OW-3
(Rev. 10/80)

FY 19 82 ANNUAL REPORT
FOR INSTITUTE DIRECTOR'S OFFICE

State where Institute is located: Georgia

Report as of September 30, 1982

Director's Name: Bernd Kahn

Annual Coop. Agreement:
No.: 14-34-0001- 0111

Cost Categories and Work-Months	Budgeted 1/	Expenditures FY 19 82 2/		
	Total	Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: Work-Months:	( )	( )	( )	( )
Other Professional Staff No: Work-Months:	( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	( )
Total:	(2,025.58)			
B. Employee Benefits Total:	301.50			
C. Non-Expendable Property Total:				
D. Expendable Property Total:	962.53	15.37		15.37
E. Other Cost (specify) Travel	(656.90)	( )	( )	( )
	( )	( )	( )	( )
	( )	( )	( )	( )
Total:	656.90			
Total Expenditures FY 19 82	(104.65)	15.37		15.37 3/

1) Amount budgeted is as set forth in budget (and revisions) submitted to and accepted by OWRT.

2) Actual expenditures including firm outstanding commitments (or obligations); for example, unliquidated orders for supplies or equipment.

3) If total of actual expenditures vary more than 10% from amount budgeted an explanation of such variance should be provided on an attachment to this sheet.

E-26-667
Q5009-1A8

Form OW-3
(Rev. 10/80)

FY 1982 ANNUAL REPORT
FOR INSTITUTE DIRECTOR'S OFFICE

State where Institute is located: Georgia

Report as of September 30, 1982

Director's Name: Bernd Kahn

Annual Coop. Agreement:
No.: 14-34-0001- 1111

Cost Categories and Work-Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: (.09)	(21,538.89)	((433.32))	( )	((433.32))
Other Professional Staff No: 1 Work-Months: .74	(2,000.00)	(2,000.00)	( )	(2,000.00)
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: 1 Work-Months: .57	(708.56)	(708.56)	( )	(708.56)
Total:	24,247.45	2,275.24		2,275.24
B. Employee Benefits Total:	3,032.06	784.80		784.80
C. Non-Expendable Property Total:				
D. Expendable Property Total:	449.07	81.51		81.51
E. Other Cost (specify) Travel	(618.66)	(551.70)	( )	(551.70)
Overhead	( )	( )	(1,706.43)	(1,706.43)
Per Diem	(446.40)	(28.80)	( )	(28.80)
Total:	1,065.06	580.50	1,706.43	2,286.93
Total Expenditures FY 1982	28,793.64	3,722.05	1,706.43	5,428.48

1) Amount budgeted is as set forth in budget (and revisions) submitted to and accepted by OWRT.

2) Actual expenditures including firm outstanding commitments (or obligations); for example, unliquidated orders for supplies or equipment.

3) If total of actual expenditures vary more than 10% from amount budgeted an explanation of suc variance should be provided on an attachment to this sheet.

E-26-625
Q5076-1A0

Form OW-3
(Rev. 10/80)

FY 1982 ANNUAL REPORT
FOR INSTITUTE DIRECTOR'S OFFICE

State where Institute is located: Georgia

Report as of September 30, 1982

Director's Name: Bernd Kahn

Annual Coop. Agreement:
No.: 14-34-0001- 2111

Cost Categories and Work-Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: 1 Work-Months: 1.10	(4,900.00)	(4,900.00)	( )	(4,900.00)
Other Professional Staff No: 1 Work-Months: 1.48	(4,026.00)	(4,026.00)	( )	(4,026.00)
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: 3 Work-Months: 3.01	(14,674.00)	(3,703.72)	( )	(3,703.72)
Total:	23,600.00	12,629.72		12,629.72
B. Employee Benefits Total:	2,898.00	1,320.87		1,320.87
C. Non-Expendable Property Total:				
D. Expendable Property Total:	2,039.00	518.37		518.37
E. Other Cost (specify) Travel	(1,500.00)	(303.02)	( )	(302.02)
Overhead	(17,290.00)	( )	(8,124.59)	(8,124.59)
	( )	( )	( )	( )
Total:	18,790.00	303.02	8,124.59	8,427.61
Total Expenditures FY 1982	47,327.00	14,771.98	8,124.59	22,896.57

1) Amount budgeted is as set forth in budget (and revisions) submitted to and accepted by OWRT.

2) Actual expenditures including firm outstanding commitments (or obligations); for example, unliquicated orders for supplies or equipment.

3) If total of actual expenditures vary more than 10% from amount budgeted an explanation of suc variance should be provided on an attachment to this sheet.

AF-95312

Form OW-3
(Rev. 10/80)

FY 19 82 ANNUAL REPORT
FOR INSTITUTE DIRECTOR'S OFFICE

State where Institute is located: Georgia

Report as of September 30, 1982

Director's Name: (Dr. R. N. North , U. Ga)

Annual Coop. Agreement:
No.: 14-34-0001- 2111

Cost Categories and Work-Months	Budgeted 1/	Expenditures FY 19 82 2/		
	Total	Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No: Work-Months:	( )	( )	( )	( )
Other Professional Staff No: Work-Months:	( )	( )	( )	( )
Grad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Undergrad. Stu. Assts. & Tech. No: Work-Months:	( )	( )	( )	( )
Non-Stu. Techs. & Others No: Work-Months:	( )	( )	( )	( )
Total:				
B. Employee Benefits Total:				
C. Non-Expendable Property Total:				
D. Expendable Property Total:				
E. Other Cost (specify)	( )	( )	( )	( )
Travel	(1,400.00)	(1,400.00)	( )	(1,400.00)
	( )	( )	( )	( )
Total:	1,400.00	1,400.00		1,400.00
Total Expenditures FY 19 82	1,400.00	1,400.00		1,400.00 3

1) Amount budgeted is as set forth in budget (and revisions) submitted to and accepted by OWRT.

2) Actual expenditures including firm outstanding commitments (or obligations); for example, unliquidated orders for supplies or equipment.

3) If total of actual expenditures vary more than 10% from amount budgeted an explanation of such variance should be provided on an attachment to this sheet.

Form OW-4
(Rev.10/80)

FY 1982 ANNUAL REPORT -- FOR THE INSTITUTE DIRECTOR'S OFFICE

Estimated Functional Distribution of FY 1982 Annual Cooperative Program Funds Expended for Operation of the Office of the Institute Director -- Georgia

	Federal	Non-Federal
1. Research program (P.L. 95-467) planning and development, including establishment of 5 year goals and objectives, and review and analysis of research project proposals	$ 6,000	$ 3,400
2. Coordinating the approved Institute P.L. 95-467 research and development and related training activities, including evaluation of progress, coordination with State agencies, etc.	$ 4,500	$ 1,000
3. Water research and training program symposia relating to current or projected P.L. 95-467 activity but not directly associated with (or included in) the budgets of specific projects	$ 400	$ 400
4.		
5.		
6.		
7. Administrative expenses, including such housekeeping activities as the preparation of Institute time and attendance reports, requisitioning miscellaneous office supplies and equipment, operating Institute mails and files systems, general Institute record keeping, etc.	$ 9,000	$ 5,000 1/
TOTAL Expenses for the Institute Director's Office	$ 19,900	$ 9,800 2/

1/ If a cost of the Institute Director's Office can be attributed to a research program activity, such as described in items 1, 2, and 3 above, then that cost should be included in that program activity and not as "administrative expenses."

2/ This dollar figure should be equal to the total "actual expenditures FY 19__" as shown on the bottom line of Form OW-3, FY 1982 Annual Report--For the Institute Director's Office.

Form OW-5
(Rev. 10/80)

FY 1982 ANNUAL REPORT
SUMMARY SHEET

ANNUAL COOPERATIVE PROGRAM /X/ or MATCHING FUND PROGRAM / /

(Prepare a Separate Summary Report for each Program and Indicate By ✓ Above)

State Where Institute is Located: Georgia

Total Number of Projects Underway, FY 1982: 24

Of these, number completed during FY: 5

Cost Categories and Work Months	Budgeted 1/ Total	Expenditures FY 1982 2/ Federal	Non-Federal	Total
A. Salaries and Wages				
Principal Investigator(s) No.: 13 Work-Months: 7.51	( )	(19,776.88)	(7,577.20)	(27,354.08
Other Professional Staff No.: 2 Work-Months: 2.22	( )	(6,026.00)	( )	(6,026.00
Grad. Stu. Assts. & Tech. No.: 13 Work-Months: 23.32	( )	(19,308.66)	(2,783.33)	(22,091.99
Undergrad. Stu. Assts. & Tech. No.: Work-Months:	( )	( )	( )	(
Non-Stu. Techs. & Others No.: 13 Work-Months: 17.28	( )	(17,016.64)	(2,500.00)	(19,516.64
Total:	114,062.43	62,128.18	12,860.53	74,988.71
B. Employee Benefits Total:	12,843.68	6,215.75	1,144.23	7,359.98
C. Non-Expendable Property Total:	5,180.20			
D. Expendable Property Total:	9,465.33	6,130.08	1,545.50	7,675.58
E. Other Cost (specify) Travel	(13,049.90)	(3,310.69)	(300.00)	(3,610.69
Per Diem	446.40	28.20		28.80
Report Preparation/Publication	(4,220.00)		(100.00)	(100.00
Equipment	1,300.00	1,073.68		1,073.68
Consultants	(5,000.00)	3,892.18		(3,892.18
Overhead	(49,506.90)		(35,203.33)	(35,203.33
Irradiation/Computer	(4,656.00)		(157.05)	(157.05
Total:	(18,178.31)	8,305.35	35,760.38	44,065.73
Total Expenditures FY 1982:	219,729.95	82,779.36	51,310.64	134,090.00

This summary report includes, but is not limited to, the following projects completed during the reported fiscal year (show OWRT project numbers):

Director's Office (14-34-0001-9011)
A-086-GA (14-34-0001-1111)
A-087-GA (14-34-0001-0111)
A-102-GA (14-34-0001-2111)

1/ Total Federal and Non-Federal amount budgeted as set forth in project budgets (and revisions) submitted and accepted by OWRT.

2/ Actual expenditures, including firm outstanding commitments (or obligations); for example, unliquidated orders for equipment.

ANNUAL REPORT - TRAINING AND EDUCATION ASPECTS OF THE WATER RESEARCH PROGRAM UNDER P.L. 95-467

Name of University: (or College) Georgia Institute of Technology and University of Georgia

SUBMIT THE INFORMATION SPECIFIED BELOW FOR THE UNIVERSITY AT WHICH THE WATER RESOURCES RESEARCH INSTITUTE OR CENTER APPROVED UNDER P.L. 95-467 IS LOCATED, AND FOR OTHER UNIVERSITIES WITH WHICH THE INSTITUTE OR CENTER IS COOPERATING. KEEP THE STATISTICS ON ENROLLMENTS, NUMBER OF STUDENTS GRADUATING, EMPLOYMENT STATUS OF GRADUATES, NEW COURSES, ETC., SEPARATE FOR EACH UNIVERSITY. IT IS RECOGNIZED CERTAIN OF THE REQUESTED DATA ON STUDENTS MAY NOT BE READILY AVAILABLE. IF SO, PROVIDE BEST ESTIMATE FIGURES. IN OW-9, DATA ON STUDENTS ARE REQUESTED ONLY FOR THOSE STUDENTS WHO RECEIVED EMPLOYMENT AS RESEARCH PROJECT OR PROGRAM ASSISTANTS THROUGH THE P.L. 95-467 PROGRAM. IF EXTRA SPACE IS NEEDED, ADD PAGES AND NUMBER EACH CONTINUATION ITEM IN THE ORDER SHOWN BELOW.

A. Number of students receiving employment as research project or program assistants through the P.L. 95-467 program. (Include only those students, both continuing and graduating, paid wholly or in part with P.L. 95-467 funds during the past fiscal year.)

Category of Students	No. by Scientific Discipline or Major Field of Study (Engineering, Biology, Economics, etc. 2/	
	Scientific Discipline of Student	Number
(1) Undergraduates	chemical engineering	1

2/ This refers to educational background prior to employment as research assistant on P.L. 95-467 projects--not to departments in which projects are being conducted.

A. (Continued)

Category of Students	No. by Scientific Discipline or Major Field of Study (Engineering, Biology, Economics, etc.)	
	Scientific Discipline of Student	Number
(2) Master's Students	Environmental Science	1
	Civil Engineering	2
	Atmospheric Sciences	1
	Geography	1
	Q uantitative Systems	1
	Agricultural Economics	1
	Agricultural Engineering	2
	Biology	
	Computer Science	1
	Environmental Health Science	1
(3) Doctoral Students	Chemistry	2
	Civil Engineering	2
	Agricultural Economics	1
	Agricultural Engineering	1
	Geography	2
	Microbiology	2
	Political Science	1
	Law	1
(4) Postdoctoral Students	Ecology	1

B. Employment status of majors in water-related fields who graduated during the school year ending about June and who receive P.L. 95-467 support.

EMPLOYMENT STATUS	CATEGORY OF SCHOOL YEAR GRADUATE BY DEGREE OBTAINED			
	Bachelor's Degree	Master's Degree	Doctoral Degree	Total
1. No. employed in water-related positions in: Total——	0	3	1	4
Federal Agencies——	(0)	(2)	(0)	(2)
State & Local Agencies——	(0)	(1)	(0)	(1)
University or College——	(0)	(0)	(1)	(1)
Other - Including private enterprise——	(0)*	(0)	(0)	(0)
2. No. graduates returning to school for advanced degree——	0	0	2	2
3. No. going into military service——	0	0	0	0
4. No. unemployed or working in other fields——	0	0	0	0
5. No. status unknown——	0	2	0	2
6. Totals——	0	5	3	8

C. Type of employment of those school year graduates who received P.L. 95-467 support and who are known to have gone into water-related positions. (Number should agree with total listed under item 1 of the preceding paragraph "B". Graduates enrolled for further course work or training should not be listed here as employed.)

Number of Graduates Engaged in Water-Related Work In:	CATEGORY OF SCHOOL YEAR GRADUATE BY DEGREE OBTAINED			
	Bachelor's Degree	Master's Degree	Doctoral Degree	Total
1A. Federal Agencies:		2		2
a. Primarily Research				
b. Primarily Planning				
c. Primarily Development				
d. Primarily Operations		2		2
e. Primarily Management				
f. Other or not known				
1B. State & Local Agencies:		1		1
a. Primarily Research				
b. Primarily Planning				
c. Primarily Development				
d. Primarily Operations		1		1
e. Primarily Management				
f. Other or not known				
1C. University or College: 3/			1	1
a. Primarily Teaching				
b. Primarily Research			1	1
c. Primarily Research & Teaching				
d. Other or not known				
1D. Other - Including Private Enterprise:				
a. Primarily Research				
b. Primarily Planning				
c. Primarily Development				
d. Primarily Operations				
e. Primarily Management				
f. Other or not known				
Totals		3	1	4

Selected summary of above data — from the "Total" column:

Research (1Aa, 1Ba, 1Cb, 1Cc& 1Da)	1
Planning (1Ab, 1Bb & 1Db)	
Development (1Ac, 1Bc & 1Dc)	
Operations (1Ad, 1Bd & 1Dd)	
Management (1Ae, 1Be, & 1De)	3

3/Do not include here students working as research assistants and receiving course credits.

Form OW-10
(Rev.10/80)

SOURCE AND APPLICATION OF INSTITUTE FINANCIAL RESOURCES
(Expenditure of Funds During the Fiscal Year) d/

Fiscal Year: 1982

State Where Institute is Located: Georgia

	ACTIVITY	OWRT Funds		Non-OWRT Funds c/			TOTAL
		Allotment a/	Other OWRT b/	Other Federal	State	Private	
1	Research & Development Program:						
1A	Annual Federal/State Cooperative Projects (ACP)	57,500		--	30,000	--	87,500
1B	OWRT Matching Fund Projects (MFP)		41,600		42,000	--	83,600
1C	OWRT Focused Research Projects		145,500	--	15,000	--	160,500
1D	Non-OWRT Sponsored Research and Development Projects			75,000	100,000	5,000	180,000
2	Subtotal - Research & Development Program (Shown Above)	57,500	187,100	75,000	187,000	5,000	511,600
3	Five-Year Water Research Priorities Development	6,000	--	--	3,400	--	9,400
4	State Research Program Development & Coordination	4,500	--	--	1,000	--	5,500
5	Technology and Information Transfer Activities	400	--	--	400	--	800
6	Administration	9,000		--	5,000	--	14,000
7	Column Totals (2 thru 6): Allocation by Source of Support	77,400	187,100	75,000	196,800	5,000	541,300

a/ Allotment - Expenditures supported by Federal funds provided by OWRT through the Annual Cooperative Program.
b/ Other OWRT - Expenditures supported by Federal funds provided by OWRT through the Matching Fund Program, Focused R&D Program, Technology and Information Transfer Program, and other OWRT programs.
c/ Non-OWRT - Expenditures supported by funds made available from sources other than OWRT.
d/ Expenditures include firm commitments, such as undelivered orders. Indirect costs or in-kind contributions applied to the Institute program during the fiscal year, even though not appearing in Institute-related accounting records, should be considered to be expenditures for purposes of this report.